PAGE'S WEEKLY.—September 8, 1905. Thin Paper Copy for Circulation Abroad.

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PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

FRANCE, Paris: 22, Rue de la Banque.
GERMANY, Berlin: 13, Unter den Linden.
RUSSIA, St. Petersburg: 14, Nevsky Prospect.
ITALY, Rome: 307 Corso.
AUSTRIA, Vienna: Kärntnerstrasse, nr. 30.

INDIA, Calcutta: Thacker, Spink & Co.
" Bombay: Thacker & Co., Ltd.
SOUTH AFRICA, Cape Town: Gordon & Gotch.
JAPAN, Yokohama: Kelly & Walsh, Ltd.
NEW ZEALAND: Gordon & Gotch, Ltd.

CANADA: Montreal News Company.
UNITED STATES, New York: International News Co.
Chicago: Subscription News Co.
AUSTRALIA, Melbourne: Gordon & Gotch.
STRAITS SETTLEMENTS, Singapore: Kelly & Walsh, Ltd.

PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY — Miscellaneous

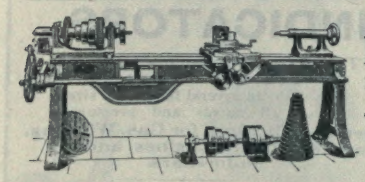
THE CASE IN A NUTSHELL

You understand the Manufacture of the goods.
We understand the Effectual Advertising of them.

The combination of the two forces produces the desired result—increased sales.

We reiterate—our aim is not to increase your advertising expenditure, but to make that expenditure more productive. May we show you how?

THE BRITISH ADVERTISER SERVICE BUREAU,
Queen Anne's Chambers, Westminster, S.W.



HIGH-CLASS
MACHINE TOOLS
In stock for immediate delivery.
THOS. W. WARD, L^D.
Albion Works,
SHEFFIELD.

STONE BREAKERS,
GRAVEL WASHERS, ETC.
SAMUEL PEGG & SONS, Engineers,
LEICESTER, England.

SEND FOR ILLUSTRATED CATALOGUE.

GUARDS
FOR SAWS, PLANERS AND MOULDERS.
Enormous Profits Easily Made.

SAWMILL, FIREWOOD, and FIRELIGHTER MACHINERY

M. GLOVER & CO., Patentees, LEEDS.

WEST PASCAGOULA CREOSOTING WORKS,
WEST PASCAGOULA, MISS., U.S.A.

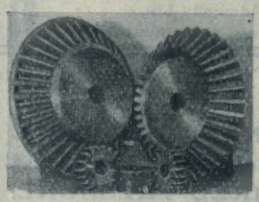
Situated on Pascagoula Bay and on the line of the Louisville and Nashville Railroad. These works have been in operation for more than twenty-six years. ORDERS for Creosoted Piles, Telegraph Poles, Cross Arms, Electric Conduits, Paving Blocks, Sawed Tiles, and Timber PROMPTLY EXECUTED. New cylinders, 115 ft. long. Capacity, one million feet per month. A.B.C. Code used. Cable address: Pierre, West Pascagoula, Miss.—Address, JNO. B. LINDSEY, Superintendent.

J. TOMEY & SON'S EUREKA GAUGE GLASS

A NEW GAUGE GLASS.
Samples, Lists, and Testimonials on application.

"S.H.P."
Tested to 350 lb. Steam Pressure.
For High Pressure Boilers.

BRETT'S PATENT LIFTER CO., LTD.
COVENTRY, ENG.
Speciality—
FORGING PLANT.
See our Advertisement appearing Sept. 29th.
SEND FOR LATEST CATALOGUE.



Rawhide Gears
A SPECIALITY.
Also all kinds of Metal Gearing.
AD. AHLERS,
Whitley Bay, Newcastle-on-Tyne.

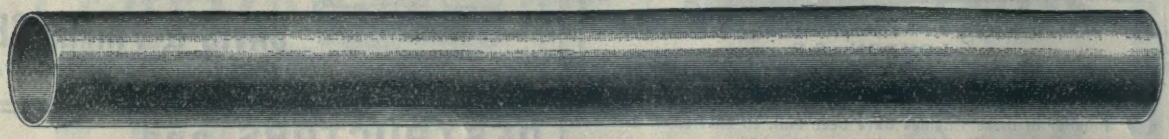
SHONE PNEUMATIC EJECTORS
FOR RAISING SEWAGE, SLUDGE, WATER, &c.
Air Compressing Machinery
FOR ALL SERVICES.

HUGHES & LANCASTER
47, VICTORIA STREET, LONDON, S.W.

WALTER SCOTT, LTD.,
LEEDS STEEL WORKS, LEEDS, ENGLAND.

MANUFACTURERS OF . . .
Rolled Steel Joists, Channels, etc.
Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.
Speciality: TRAMRAILS.

WELDED AND RIVETED STEEL PIPES.



THOMAS PIGGOTT & CO., LTD., SPRING HILL, BIRMINGHAM. **Send for Catalogue.**

CAST-IRON COLUMNS,
STANCHIONS AND GIRDERS.
Head, Wrightson & Co., Thornaby, Stockton-on-Tees.

RIVETS, BOLTS, & SCREWS
Of all Descriptions and for all Purposes.
SEND FOR CATALOGUE.
T. D. ROBINSON & CO., Ltd.,
DERBY.

Rochester Card
Bundy Key
Signature
Journey
Speed
} **RECORDERS.**

For further particulars . . of our . . see our whole page Ad. on Sept. 29th.

TIME RECORDERS

RECORDERS, LTD., 171, Queen Victoria Street, LONDON, E.C.

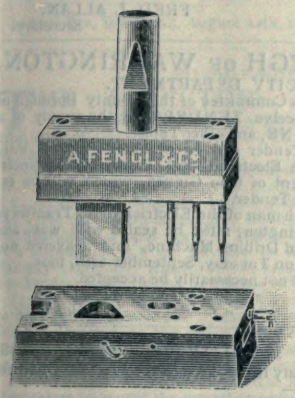
PAGE'S WEEKLY

Miscellaneous

"ZECO" Brand.

Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.



DO YOU WANT ANY

Press Tools, Jigs, Cutters, Rimers, Gauges?

If so, send your requirements, and

A. FENGL & CO., ALTRINCHAM,

will submit design and price.

Inventors' Models Worked Out and Manufactured.

STAMPINGS TO THE TRADE.

Telegrams: "Fengl, Altrincham."

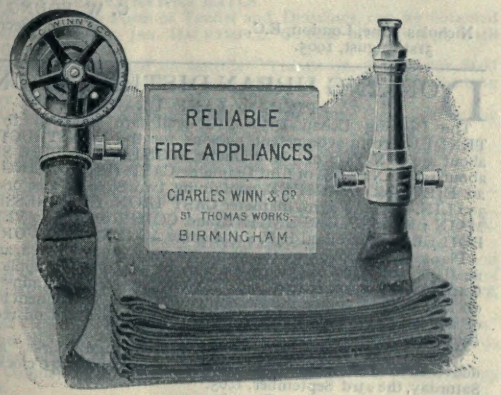
TRANSPORTERS.

See our Advertisement appearing Sept. 29th.

TEMPERLEY TRANSPORTER CO.,

72, Bishopsgate Street Within, LONDON, E.C.

Telephone: 365 London Wall Telegrams: "Transumo."



Refuse Destructors.

Write for particulars to:—

HEENAN & FROUDE, LIMITED,

4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.

HIGH-CLASS NON-CORROSIVE

LUBRICATING OILS AND SOLIDIFIED LUBRICANTS.

(Castor, Lard, Olive, Neatsfoot, and Linseed Oils, Tallow, &c.)

RELIANCE LUBRICATING OIL CO.,

19 & 20, Water Lane, Great Tower Street. LONDON. E.C.

Also at GLASGOW, HULL, BRISTOL, AND NEWCASTE-ON-TYNE.

INSULATORS.

BRITISH LABOUR

TELEGRAMS "EBONESTOS" LONDON. TELEPHONE Nº 1422 HOLBORN.

EBONESTOS MFG.Co

22 ROSOMAN ST CLERKENWELL LONDON. E.C.

PRICE & PARTICULARS LISTS ON APPLICATION.

INSULATORS.

BERTRAMS, Ltd.,

Sciennes, EDINBURGH.

MACHINE TOOLS.

See Next Week.

EDGAR ALLEN & CO.,

Limited,

Sheffield.

TRAMWAY MATERIAL.

IN ALLEN'S

IMPERIAL

MANGANESE STEEL.

CONTRACTS.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

WATERWORKS.—CONTRACT No. 1.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the Council invite TENDERS for the SUPPLY and ERECTION at their Waterworks of a CORNISH BOILER, 16 ft. long by 6 ft. diameter, fitted with Meldrum's Patent Furnaces.

Specification and Forms of Tender can be obtained on application to the undersigned on payment of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Waterworks, Cornish Boiler," to be sent to me, the undersigned, by 4 o'clock p.m. on Tuesday, the 19th day of September, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
THOS. SWATHERIDGE,
Clerk to the Council.

Council Offices, 7, North Street, Bishop's Stortford,
August 14th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

AMENDED ADVERTISEMENT.

SEWAGE WORKS.—CONTRACT No. 1.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the Council invite TENDERS for :—

Supplying and Fixing Gas Pumping Engine, Suction Gas Plant and Sewage Pumps at their Sewage Pumping Station.

Specification and Form of Tender can be obtained on application to the undersigned.

The person or firm whose Tender is accepted will be required to enter into a written contract, and to provide two eligible sureties.

Sealed Tenders, endorsed "Tender for Pumping Engine," to be sent to me, the undersigned, by 4 o'clock p.m. on Tuesday, September 12th, 1905.

The Council do not bind themselves to accept any Tender.

By order,
THOS. SWATHERIDGE,
Clerk to the Council.

Council Offices, 7, North Street, Bishop's Stortford,
July 21st, 1905.

URBAN DISTRICT OF PEMBROKE (IRELAND).

ELECTRICITY SUPPLY.

The Council of the Urban District of Pembroke (Ireland) are prepared to receive TENDERS for the following :—

Section M.—ELECTRICITY SUPPLY MAINS.
Section N.—ARC LAMPS AND PILLARS.
Section O.—HOUSE METERS.
Section P.—SWITCHBOARD PANELS.

General Conditions, Specification, Drawings, Forms of Tender, and Form of Agreement may be inspected at the offices of the Clerk of the Council, Town Hall, Pembroke, co. Dublin, and at the offices of Messrs. ROBERT HAMMOND AND SON, the Consulting Engineers to the Council, 64, Victoria Street, Westminster, S.W., and may be obtained at the latter on and after Saturday, August 26th, 1905, on making a deposit of £5, which sum will be refunded to *bona fide* Tenderers, after the Tenders have been adjudicated upon. Extra copies of the Specification may be obtained by *bona fide* Tenderers at a charge of five shillings per copy, which sum will not be refunded.

Tenders (sealed and marked "Tender for Electricity Plant") must be addressed to me at the Town Hall, Ball's Bridge, co. Dublin, and be delivered on or before 10.30 a.m. on Friday, September 22nd, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

Town Hall, Pembroke, August 24th, 1905.

J. C. MANLY,
Clerk of the Council.

METROPOLITAN WATER BOARD.

TENDERS FOR STEAM ENGINE AND PUMPS.

The Metropolitan Water Board invite TENDERS for PROVIDING and FIXING a STEAM ENGINE, with LIFT and FORCE PUMPS (capable of delivering 500,000 gallons of water in 24 hours), on the Board's land at the Hill Park Estate, Westerham, Kent.

Forms of Tender and Contract, with Specification and Drawings, may be obtained on application to the District Engineer, at the Board's Offices, Brookmill Road, Deptford, S.E., on production of an official receipt for the sum of Five Guineas, which sum must first be deposited with the Comptroller at the Board's Central Offices, Savoy Court, Strand, W.C., and which will be returned on receipt of a *bona fide* Tender.

Such application must be made between the hours of 10 and 4 (except on Saturdays) on and after Friday, the 1st September next.

Tenders, endorsed "Tender for Pumping Engine, Westerham, Kent," must be sent in sealed envelopes to the undersigned not later than 10 a.m. on Monday, October 2nd, 1905.

The Board do not bind themselves to accept the lowest or any Tender.

(Signed) A. B. PILLING,
Clerk of the Board.

Office of the Board, Savoy Court, Strand, W.C., August 29th, 1905.

CORPORATION OF DUBLIN.

The LIGHTING COMMITTEE of the Corporation of Dublin are prepared to receive TENDERS for the SUPPLY of

(*a*) SUB-STATION SWITCHBOARDS, TRANSFORMERS, &c.
(*b*) EXTRA HIGH-TENSION and LOW-TENSION MAINS.

Specifications, with General Conditions and Form of Tender, can be obtained from the City Electrical Engineer, Fleet Street, Dublin, on and after September 4th, on payment of One Guinea for each Section, which will be returned on receipt of a *bona fide* Tender.

Tenders, addressed "Chairman of the Lighting Committee, 3, Cork Hill, Dublin," and marked "Tenders for Sub-Station Switchboards, &c.," to be forwarded not later than Monday, the 18th September next.

FRED. J. ALLAN,
August 29th, 1905. Secretary.

COUNTY BOROUGH OF WARRINGTON.

ELECTRICITY DEPARTMENT.

The Electricity and Tramways Committee of the County Borough of Warrington are prepared to receive TENDERS for the supply of a LATHE, DRILLING MACHINE, and other Tools.

Specification and Form of Tender can be obtained from F. V. L. MATHIAS, A.M.I.E.E., Borough Electrical and Tramways Engineer, Howley, Warrington, on payment of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Tenders addressed to the Chairman of the Electricity and Tramways Committee, Town Hall, Warrington, must be sealed with wax, and endorsed "Tender for Lathe and Drilling Machine," and delivered not later than Twelve o'clock noon on Tuesday, September 12th, 1905.

The lowest or any tender will not necessarily be accepted.

J. LYON WHITTLE,
Town Hall, Warrington. Town Clerk.

EAST INDIAN RAILWAY.—The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and delivery of :—

(1) STEEL FISH-PLATES,
(2) STEEL FISH-BOLTS and NUTS,

as per Specification to be seen at the Company's offices.

Tenders are to be sent to the undersigned, marked "Tender for Fish-plates," or as the case may be, not later than Twelve o'clock noon on Wednesday, the 13th day of September proximo.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each Specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Nicholas Lane, London, E.C. Secretary.
31st August, 1905.

DORKING URBAN DISTRICT COUNCIL.

PIXHAM LANE DRAINAGE.

The Dorking Urban District Council are prepared to receive TENDERS from competent persons for the CONSTRUCTION of about 250 LIN. YDS. of 9 in. diameter STONEWARE PIPE SEWER; about 120 LIN. YDS. of 6 in. Diameter CAST IRON RISING MAIN; an EJECTOR CHAMBER, containing two Shone's ejectors; about 300 LIN. YDS. of 2½ in. diameter CAST IRON COMPRESSED AIR MAIN; a 4 H.-P. GAS ENGINE and COMPRESSOR; a VERTICAL BOILER of 12 nominal H.P.; and some ACCESSORY WORKS.

Plans and Sections of the proposed works may be seen, and Specifications and Bills of Quantities may be obtained on application to GEO. R. STRACHAN, M.Inst.C.E., 9, Victoria Street, Westminster, S.W., on and after Monday, the 4th September, 1905, on payment by cheque of a deposit of Two Guineas, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Tender for Sewage Works," are to be delivered to me at my office in Dorking, on or before 10 o'clock a.m. on Saturday, the 23rd September, 1905.

By order,
W. J. HODGES,
August 22nd, 1905. Clerk to Dorking U.D.C.

COUNTY BOROUGH OF STOCKPORT.

TO ELECTRICAL CABLE MAKERS.

The GAS and ELECTRICITY COMMITTEE invite Tenders for the Supply and Laying of Electric Lighting Cables.

Specifications, Conditions, and Form of Tender may be obtained on application to Mr. A. J. H. CARTER, Borough Electrical Engineer, Millgate, Stockport.

Tenders addressed to the Chairman of the Gas and Electricity Committee, and endorsed "Electric Cables," to be handed in at the Town Clerk's Office, Stockport, not later than first post on Thursday, September 14th, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT HYDE,
Stockport, August 28th, 1905. Town Clerk.

PAGE'S WEEKLY — Contracts and Appointments Open

THE SECRETARY OF STATE FOR India in Council is prepared to receive TENDERS from such persons as may be willing to supply :—

1. DOG SPIKES for RAILS.
2. WHEELS AND AXLES for CARRIAGES and WAGONS.
3. CARRIAGE IRONWORK AND FITTINGS.

The conditions of contract may be obtained on application to the Director-General of Stores, India Office, Whitehall, S.W., and Tenders are to be delivered at that office by Two o'clock p.m. on Tuesday, the 5th September, 1905, for Nos. 1 and 2; and on Tuesday, the 12th September, 1905, for No. 3, after which times respectively no Tender will be received.

E. GRANT BURLS,
Director-General of Stores.

India Office, Whitehall, August 24th, 1905.

TO SHIPBUILDERS.

THE DIRECTORS OF THE GREAT Central Railway Company are prepared to receive TENDERS from Shipbuilders for the CONSTRUCTION of TWO NEW TURBINE STEAMERS.

Contract Drawings and Specification may be seen at the office of Mr. F. J. TREWENT, 43 and 44, Billiter Buildings, Billiter Street, London, E.C., on and after Monday, August 28th, between the hours of 11 a.m. and 4 p.m. (except on Saturdays), when copies of the Contract Drawings and Specification and Form of Tender may be obtained on the deposit of a cheque for £5 5s., payable to the order of the Great Central Railway Company, which will be returned on the receipt of a *bona fide* Tender, accompanied by the above-mentioned documents.

Tenders in envelopes endorsed "Tender for New Steamers," must be delivered, accompanied by the above-mentioned Contract Drawings and Specification, at the office of the Secretary of the Great Central Railway Company, Marylebone Station, London, N.W., at or before noon of Thursday, September 14th, 1905.

The Directors of the Great Central Railway Company do not bind themselves to accept the lowest or any Tender.

(Signed) O. S. HOLT, Secretary.

Marylebone Station, N.W.,
August 23rd, 1905.

GLASGOW CORPORATION TRAMWAYS.
STEEL RAILS AND FISHPLATES.

The Corporation of Glasgow are prepared to receive TENDERS for the SUPPLY of the undernoted material :—

1500 to 2000 STEEL STRAIGHT TRACK RAILS.
150 Tons STEEL CURVING RAILS.

Specification, with Form of Tender and Drawings, can be obtained on application to Mr. JAS. DALRYMPLE, General Manager, 46, Bath Street, Glasgow.

Sealed Tenders, marked on outside "Tramways, Tender for Steel Rails," must be lodged with the Subscriber not later than five p.m. on Monday, 11th prox.

The Corporation do not bind themselves to accept the lowest or any offer.

JOHN BOWERS, Town Clerk.

City Chambers, Glasgow, August, 1905.

BURGH OF OBAN.—ELECTRIC LIGHTING.

The Town Council invite Tenders for the supply, delivery, and connecting up of new feeders and distributing main, &c. Copies of the Specification and Plan can be obtained from Mr. M. P. PLUNKETT, Burgh Electrical Engineer, Electricity Works, Oban.

Sealed Tenders, addressed to me and endorsed "Tender for Cables," must be delivered at my office not later than ten a.m. on Monday, September 11th, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

ALEXANDER S. BLACK, Town Clerk.

Oban, August 29th, 1905.

NORTH-EASTERN RAILWAY. — TO CONTRACTORS.—The DIRECTORS are prepared to receive TENDERS for the CONSTRUCTION and ERECTION of the NEW STEEL SWINGBRIDGE over the River Hull at Sculcoates, on their Victoria Dock Branch, and weighing about 460 tons. The Contract will include the Removal of the existing Swingbridge, the Raising of the Public Road, and the Building of River Walls, Timber Jetty, &c. Plans may be seen, and Specification, detailed Lists of Quantities, and Forms of Tender obtained, on personal application at the office of Mr. W. J. CUDWORTH, the Company's Engineer, at York, on and after August 14th, 1905. The Directors do not bind themselves to accept the lowest or any Tender. Sealed Tenders, marked "Tenders for the Reconstruction of the Swingbridge at Sculcoates," to be sent to the Secretary at York not later than noon on Monday, September 11th, 1905.

York, August 3rd, 1905. R. L. WEDGWOOD, Secretary.

APPOINTMENTS OPEN.

EAST INDIAN RAILWAY.—
ASSISTANT STOREKEEPER.

The Directors of the East Indian Railway Company are prepared to receive APPLICATIONS, by letter only, from duly qualified candidates for the APPOINTMENT of ASSISTANT STOREKEEPER.

Candidates must have received a good general education, followed by a professional training as mechanical engineers in some large Locomotive or Carriage and Wagon Factory, preferably those of an English Railway Company, and *caeteris paribus*. Preference will be given to one who has had subsequently a considerable experience in the special business of the ordering, keeping, and issue of railway stores.

Age must not be under 28 years of age, or, unless applicant has had Indian experience, more than 35.

Salary, Rs 650, rising to Rs. 750 per calendar month.

Terms, a four years' agreement, with first-class free passage to India.

The selected candidate will be required to pass a medical examination by the Company's Consulting Physician before appointment.

Letters of application, accompanied by a brief record in chronological order of the candidate's career, with dates, together with copies (not originals) of testimonials, and a medical certificate of fitness for residence in India, should be addressed to the undersigned not later than the 13th September, 1905.

By order,
C. W. YOUNG,
Secretary.

28-30, Nicholas Lane, London, E.C.,
August 28th, 1905.

THE MADRAS RAILWAY COMPANY REQUIRE the services of a BRIDGE INSPECTOR in India. Candidates, preferably unmarried, must have been trained as platers, riveters, and girder erectors in one of the leading shops in the United Kingdom, and be experienced in the erection of false works and girders and be capable of taking sole charge of such work.

Commencing salary Rupees 250 per month, rising to Rupees 300; after two years of approved service, covenant for four years. Free passage to Madras.

Application, stating age, experience, &c., to be addressed not later than September 18th to W. H. COLE, Secretary.

1, Broad Street Place, Finsbury Circus,
London, August 16th, 1905.

BOROUGH OF KING'S LYNN.
APPOINTMENT OF BOROUGH SURVEYOR AND WATERWORKS ENGINEER.

The Corporation invite applications for the appointment of Borough Surveyor and Waterworks Engineer, at a salary of £250 per annum.

The gentleman appointed must devote the whole of his time to the duties of the office, and must not engage in private practice.

The conditions on which the appointment will be made can be obtained from the undersigned, to whom all applications, endorsed "Borough Surveyorship," and accompanied by copies of not more than three recent testimonials, must be delivered not later than the 18th of September next.

J. W. WOOLSTENCROFT,
Town Clerk.

Town Hall, King's Lynn,
August 22nd, 1905.

COUNTY BOROUGH OF CROYDON
EDUCATION COMMITTEE.

The Committee invite APPLICATIONS for the Post of PRINCIPAL of the POLYTECHNICS, at a salary of £350 per annum.

The gentleman appointed will be required to devote the whole of his time to the duties of his office, and will be responsible for the development and organisation, discipline, and educational efficiency of the instruction given in the Polytechnics.

The instruction at these centres is, for the most part, given in the evening, and in addition to Classes in Science, Art, Trade, Commercial and Domestic Subjects, there are Evening Courses in Mechanical and Electrical Engineering.

The Principal will also be required to superintend any other evening classes established, or to be established by the Committee, and to advise and assist the Committee in the co-ordination of all classes of education.

Candidates must not be over 45 years of age, and must hold University or other professional qualification.

A Prospectus of the classes held in the Polytechnics, together with copies of the Form of Application and Statement of Duties, may be obtained from the undersigned, to whom applications, accompanied by copies of testimonials of recent date, must be sent not later than September 11th, 1905.

JAMES SMYTH, Clerk.

Education Office, Katharine Street, Croydon,
July 20th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Coke Oven Expert.
Mallmann, P. J., 110-118, Victoria Street, S.W.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie. Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Ebonestos Manufacturing Co., 22, Rosoman Street, London, E.C.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co. (*see* Ebonestos Manufacturing Co.), 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds, England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin, Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co., Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

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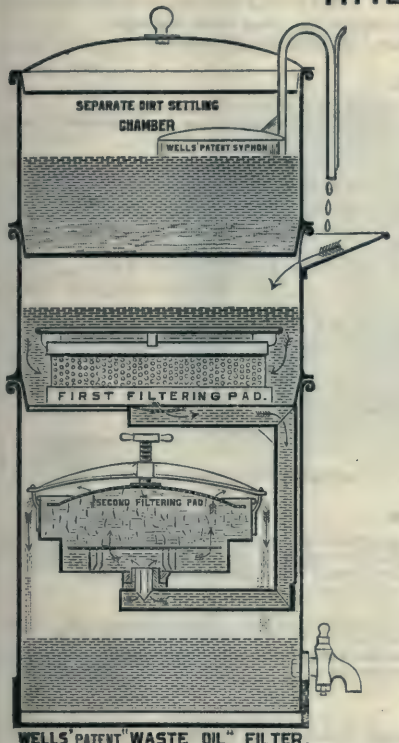

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No. 3.—Two top chambers hold about 6 gallons oil, 27 in. by 12 in. ...	70/-
No. 4.—Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ...	110/-
No. 5.—Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ...	189/-
No. 6.—Very powerful Filter for treating large quantities of oil, 54 in. by 30 in.	336/-

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No. 4A.	Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose, **Same capacity as No. 4 Machine.**	£9 10s.
No. 5.	With 5-ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

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Photo Copying Frames.
J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.
Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.
Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.
Wm. Firth, Ltd., Leeds.

Railway Wagons.
Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.
F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.
Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.
D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).
Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.
Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).
Rubber Stamp Co., 1 & 2 Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).
Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.
British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.
Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.
Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.
Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.
S. Pegg & Son, Alexander Street, Leicester.

Superheaters.
A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.
Howard Bros., 40, Paradise Street, Liverpool, and 100c, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.
Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.
Greenwood & Batley, Albion Works, Leeds.
S. Howes Co., 64, Mark Lane, London, E.C.

Typewriters.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.
Holmes & Co., W. C., Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North, Birmingham.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.
Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.
Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Weighing Apparatus.
W. & T. Avery, Ltd., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.

Wells Light.
A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery.
Eric S. A. Smith, Bridlington.

Wire Working Machinery.
Ed Brand 35, Shakespeare Street, Manchester.

"Woodite."
"Woodite" Company, Mitcham, Surrey.

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PAGE'S WEEKLY — Machine Tools

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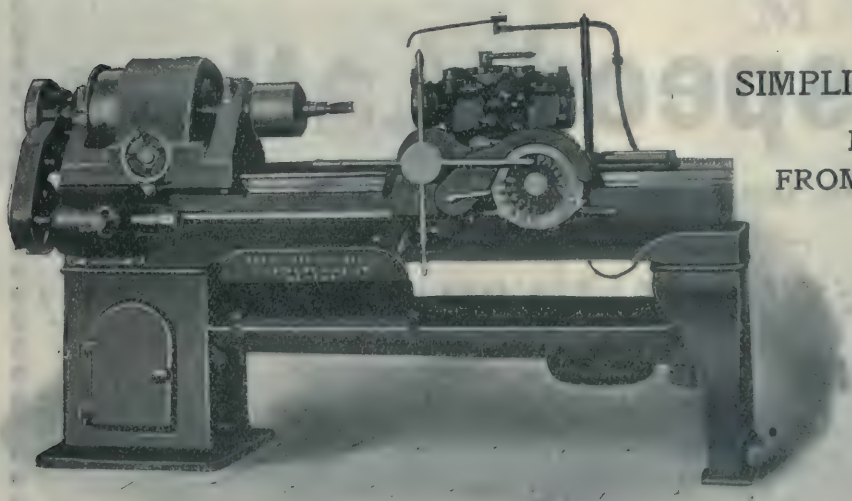

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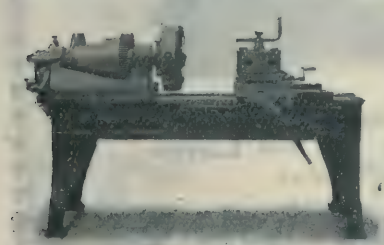

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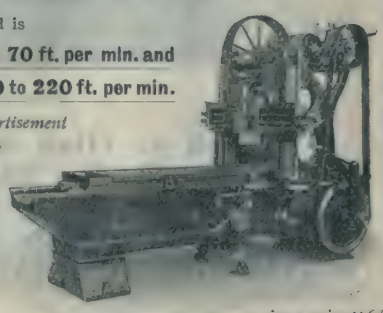

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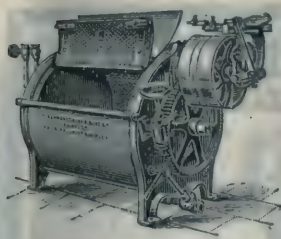
PAGE'S WEEKLY — Machine Tools

PAGE'S WEEKLY — Machine Tools, &c.



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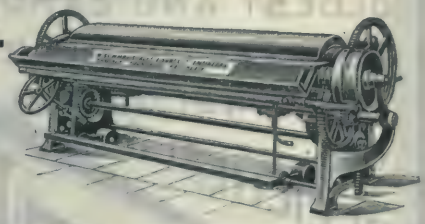

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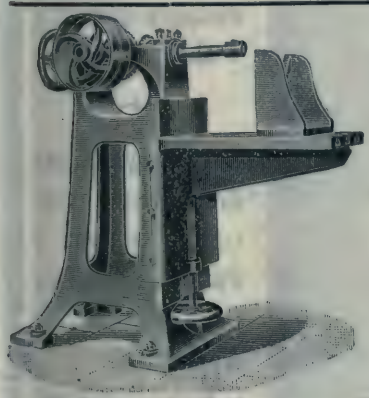

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Standard Milling Machine

For

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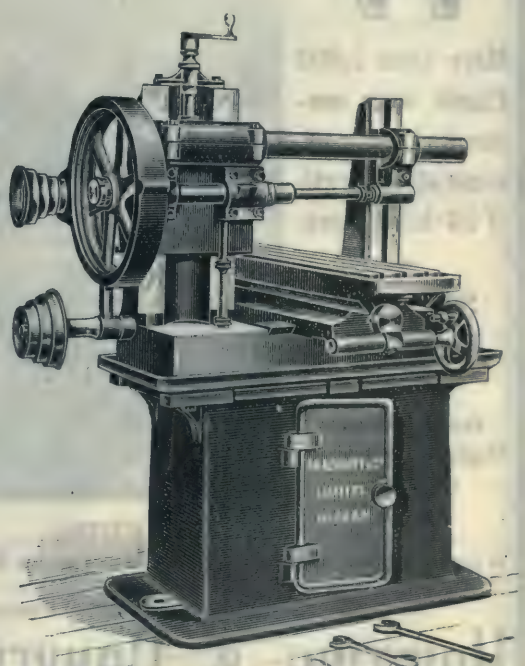

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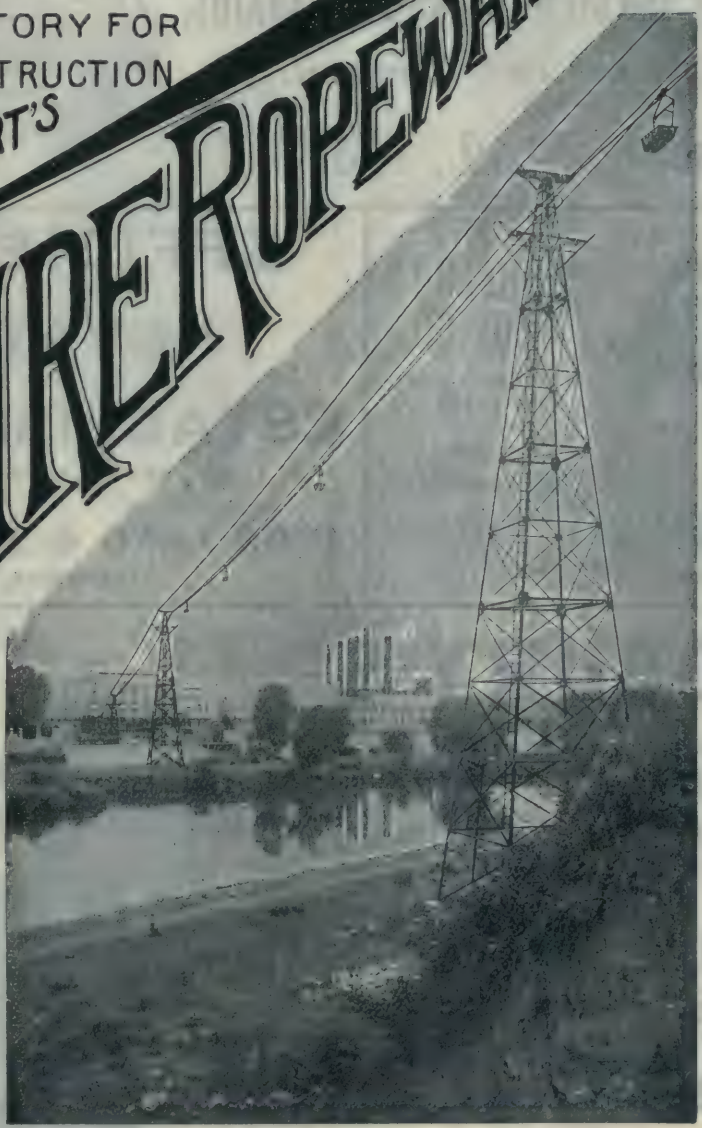
WIRE ROPEWAYS



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PAGE'S WEEKLY **Systems for Engineers**

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P—15

1. FACTORY COSTS
2. STORES LEDGERS
3. PERPETUAL CARD LEDGERS
4. QUOTATIONS—GIVEN
5. QUOTATIONS—RECEIVED
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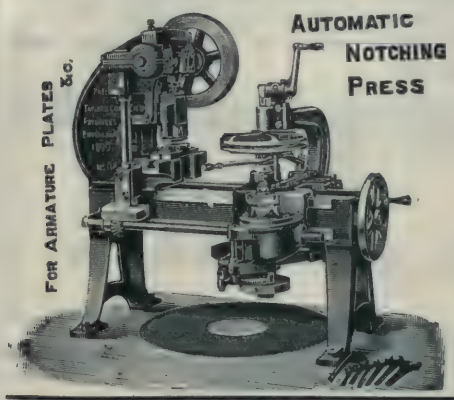
PAGE'S WEEKLY

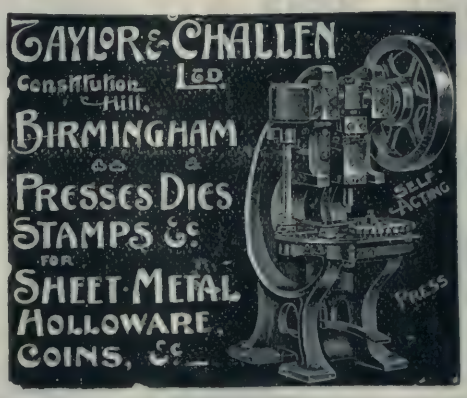
Miscellaneous

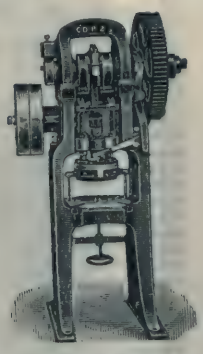
Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE'S WEEKLY — Miscellaneous







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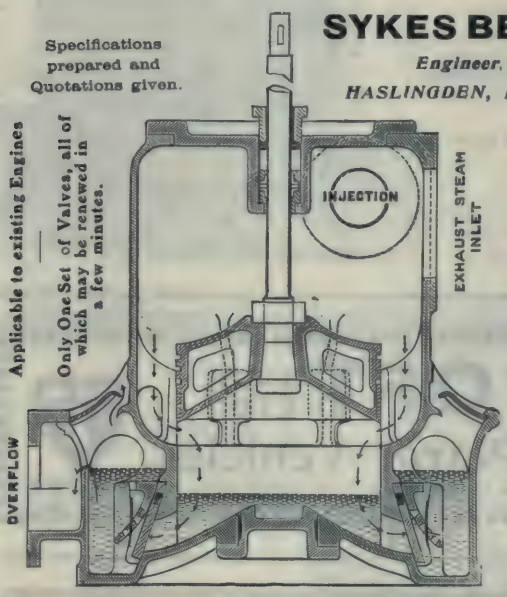

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PAGE'S WEEKLY

Miscellaneous

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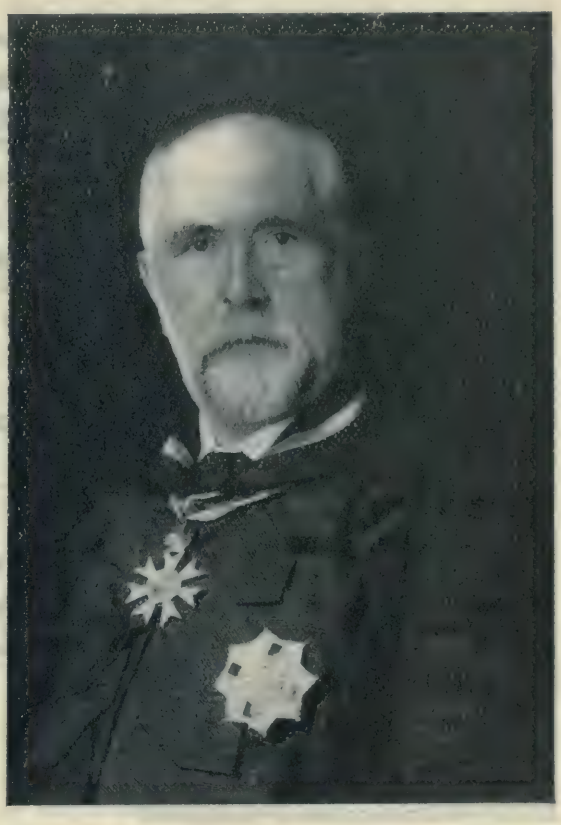
PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VII. LONDON, FRIDAY, SEPTEMBER 8, 1905. No. 52.

The Offices of "Page's Weekly," Wednesday Evening.

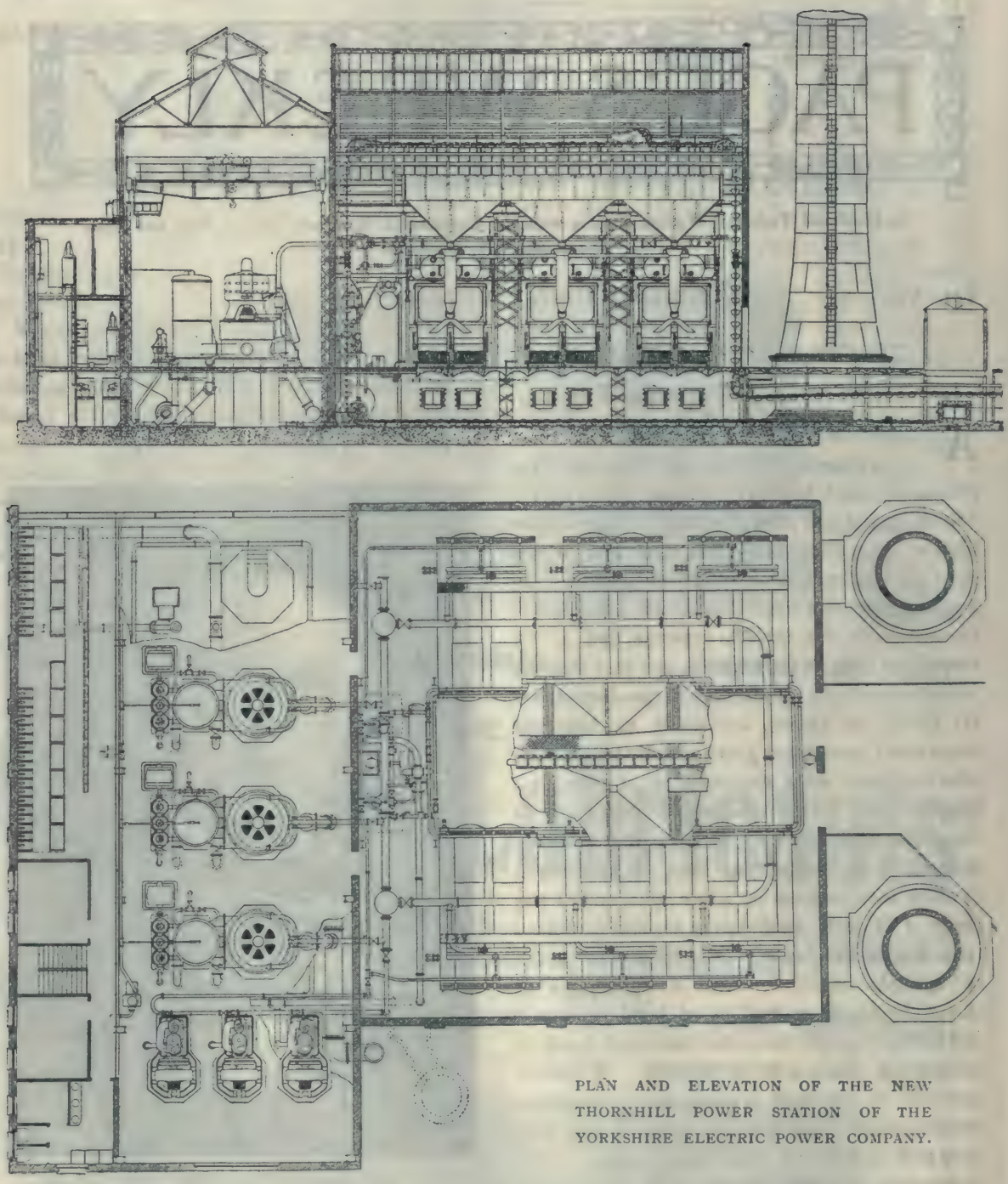
AN American journal publishes a letter from an eminent English professor, in the course of which he is represented as saying:—"In England our lawyers and judges almost without exception are quite ignorant of the most elementary facts of physical science. In a patent case the court has to be educated in these matters at a terrible expense, and at the end of ten days or twenty days one sees that the judge is nearly as ignorant as at the beginning. He thinks he knows, but really he has only some fixed impression given him by that lawyer who has been most successful in studying his idiosyncrasy. Our system of education is altogether bad, and I am not sure that yours in America is any better than ours. It is criminal to allow men to grow up quite ignorant of the study of Nature, unable even to take a lesson from Russia and Japan. Of course your court of appeals ought to have a knowledge of physical science as well as of legal science—but unless you get men who have both kinds of knowledge there will be trouble. A lawyer ignorant of physical science and a scientific expert make a team that are never in step, and they pull in different directions." This is very interesting, as a side-light upon an old-standing grievance, but if the "law is an ass" it is difficult to see that anything can be gained from sweeping condemnations in the American press, while the statement that "In England our lawyers and judges almost without exception are quite ignorant of the most elementary facts of physical science" will not, we fancy, be accepted even by Americans, without the proverbial "grain of salt."



Photo, Elliott and Fry.

SIR DAVID HUNTER, K.C.M.G.

The General Manager of the Natal Government Railways was born in Linlithgowshire, 1841. At the age of twelve he entered the service of the North British Railway as an apprentice. Having gained experience in all departments of the railway he was in 1879 appointed to his present post. Two years later he was elected member of the Natal Harbour Board and delegate to several conferences on railway and harbour matters. He was a member of the Coal Industry Commission of 1898, and during the Transvaal war was frequently mentioned in dispatches.



PLAN AND ELEVATION OF THE NEW THORNHILL POWER STATION OF THE YORKSHIRE ELECTRIC POWER COMPANY.

The station has been designed with a view to reducing the cost per kilowatt to a low figure without in any way sacrificing security or efficiency. Two Curtis turbo-alternators, each of 2,000 kilowatts capacity are already installed, and a third is being erected. The four Babcock and Wilcox boilers are fitted with superheaters and mechanical chain grate stokers. Each boiler is constructed for a working pressure of 160 lb. per square inch. The Babcock Silent Gravity Bucket Conveyer is designed to handle 20 tons of coal per hour.

In this country men have been known to swear by the bones of their ancestors. In China it appears that under favourable circumstances you can raise money on them. All you have to do is to find out where the western foreign devil is going to lay his railway line, indicate rich clumps of ancestral clay, and receive compensation for their removal at from 10s. to £1 per lot. The only swearing (excusable surely under the circumstances) will probably be done by the engineer in consequence of the harassing friction and delay. Between Shanghai and Wusieh the country is practically a continuous graveyard. Tombs are scattered haphazard, and many of them are quite elaborate; consequently in the construction of the new railway from Shanghai to Nanking by British engineers, John Chinaman is literally making money all along the line. There is in that part of the world an official called Sheng, which is possibly an abbreviation for shekels, at any rate the gentleman seems to have an appetite for the discovery of graves, which is positively ghoulish.

Occasionally when there are no descendants to look after the precious skulls of the departed one might have expected that John would let the matter pass. But no! The Times Shanghai correspondent records that so-called "benevolent" societies have been formed at various centres, and collect subscriptions with the ostensibly pious object of removing the remains of the numerous departed Chinese who have left no descendants to practise the rites of filial piety. The Tai-ping rebellion left many such cases in its track. These societies employ coolies to collect the bones, which are then reverently placed in a Devoe's kerosene packing case, or other equally inexpensive receptacle, and thereafter deposited on the nearest piece of waste land, the society's work being confined to claiming and getting the compensation per set of bones collected. The smallest remains will suffice to justify a claim, and unidentified ancestors are therefore freely in demand. It is reported, though difficult to prove, that the Chinese members of the Board of Commissioners and other local mandarins have been prominently connected with these highly "benevolent" societies.

Many bones have been removed during the past year, but even on the land already handed over an enormous number remain, and for these gaps have to be left in the embankments. The patience of engineers is not inexhaustible, and a line must be drawn somewhere. It is said that the Chinese have been given to understand that each man in future must be limited to four parents, and sixteen grand-parents. In spite of these difficulties and others consequent upon the rapacity of Chinese officialdom in the matter of "corners" in skilled labour, bricks, and ballast, construction work on the railway is proceeding rapidly. The correspondent states that the working plans and sections of the line have been completed as far as Wusieh, and the survey to Nanking is advancing. Embankment work is proceeding rapidly wherever possible. The first consignment of rails has arrived from England, the sleepers from Australia have been shipped, and of the girder-work and rolling stock ordered in Engand, much is already on its way to China.

Unless new difficulties arise the engineers hope that the first section to Naziang will be opened to traffic in October; the second, to Quinsan, at the end of the year; to Soochow in March, 1906, and to Wusieh, the great silk district, in June. As to the financial prospects of the railway, opinion is practically unanimous that the undertaking cannot fail to be highly remunerative It is mentioned that between Shanghai and Soochow the railway passes a town or village every 500 ft. within a quarter of a mile from its centre line; in other words,

no fewer than 549 centres ot rural population have been located on the surveys of the 52 miles in this section.

According to the latest consular report, a further and marked improvement in the financial and commercial condition of Peru is perceptible. The revenue continues to increase and is now nearly £2,000,000. The national income is, therefore, more than double what it was ten years ago, but inasmuch as a large sum is to be set aside annually for railway construction or for the guarantee of the interest on the capital which may be invested in such works, the available balance is still quite inadequate to meet the requirements of the other public services. The country has now enjoyed peace for a number of years, and appears to be bent solely on developing her prolific sources of wealth. Credit is also reviving, as is proved by the gradual and not inconsiderable influx of foreign capital and the formation of new companies with capital raised in the country. These companies show no lack of enterprise.

The Government are paying attention to the extension of the railways and the construction of roads and bridges, but they can only carry out these works on a small scale. However, ere long they will probably have financial assistance, as they are now in a position to offer sound guarantees, being prepared to farm out, if necessary, the proceeds of the tobacco tax, which should yield about £200,000 a year. Under the circumstances the sphere of enterprise appears destined to extend, and it is not unlikely that even greater progress will be made than is anticipated.

The satisfactory commercial intercourse which already obtains between this country and Peru might be increased by studying more closely the requirements of the markets. The total imports and exports in 1904 amounted to £8,364,642. In the distribution of the trade the United Kingdom, India, and the Colonies were able to lay claim to 45 per cent. of the whole.

In view of the recent gold discovery in Ireland, the following table is particularly interesting, showing the results of the spasmodic working of the Ovoca gravels. It originally appeared in an article on "The Mode of Occurrence and Winning of Gold in Ireland," contributed to the Journal of the Royal Geological Society of Ireland. There was a rush of peasants to Ballinvalley in 1765 consequent upon the discovery of a small nugget in the brook which flows into the Aughrim river near its junction with the Ovoca, but the authorities sent militia to terminate their rude attempts at gold washing, and, as will be seen from the table, the Government made several attempts to work the gravels with more or less success. There was, however, no continuity of action, and the peasants were on several later occasions suffered to resume surreptitious operations. The estimated results of their labours, given in the table, are probably somewhat liberal.

Worked by	Duration of Works	Gold			Authorities
		Ounces.	Value	Largest Nuggets	
Peasants ..	To October 15th, 1795	From 800 to 2,666	£ s. d. 3,000 0 0 to 10,000 0 0	oza dwts grs 22 0 0 20 2 21 5 0 9 2 17 0	Mills. R. Molesworth Mills. Do.
Government	August 12th, 1796, to May 26th, 1798	ozs dwts grs 555 17 22½	2,346 15 0	18 0 0 9 0 0	Reports to the Government by Messrs.
	Sept. 8th, 1800, to June 24th, 1801	43 9 10	182 14 11½	7 0 0 2 10 0	King, Weaver & Mills.
	June, 1801, to 1803	344 17 6¾	1,415 18 9	3 2 19	Royal Dublin Society, nugget
Peasants ..	To 1839 ..	5,000 0 0	20,000 0 0	4 10 0	Estimated in 1840.
Crockford & Company	4 months in 1840	600 0 0	1,800 0 0	11 0 0	Returns to H.M. Commissioners of Woods and Forests.
Peasants ..	To 1857 ...	?	?	24 0 0 6 0 0	Hugh McDermott, Arklow.
Carysfort Mining Company	1862 to 1866 ...	52 11 5	203 6 0	0 13 8 0 4 9 0 3 11	Geological Survey, Dublin, Director's Report
Mr. F. Acheson	1876 to 1879 ..	14 3 0	60 0 0	?	Mineral Statistics.

It will be noted that the record includes nuggets of 24, 22, 20, 18, and 11 oz.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Editorial.—*All communications intended for publication should be written on one side of the paper only, and addressed to "The Editor."*

Any contributions offered, as likely to interest either home or foreign readers, dealing with the industries covered by the Weekly, should be accompanied by stamped and addressed envelope for the return of the MSS. if rejected. When payment is desired this fact should be stated; and the full name and address of the writer should appear on the MSS.

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Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

The Editor does not hold himself responsible for the opinions expressed by individual contributors, nor does he necessarily identify himself with their views

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When Foreign Subscriptions are sent by Post Office Orders, advice should be sent to the Publisher.

Foreign and Colonial Subscribers receiving incomplete copies through newsagents, are requested to communicate the fact to the Publisher, together with the agent's name and address.

New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

NEWS ITEMS.

Sir Lees Knowles, Bart., has been nominated as president of the Institution of Mining Engineers for the current year.

The finding of another large diamond on the property of the Premier Diamond Company is reported. It is said that the diamond weighs 460 carats, and is practically flawless.

Sir William H. Preece, K.C.B., is to be president of the forthcoming Electrical Exhibition, which, as already announced, will be held at Olympia from September 25th to October 21st. The offices of the exhibition are at Balfour House, Finsbury Pavement, London, E.C., the organising managers being Messrs. F. W. Bridges and G. D. Smith.

The new Talla water works for the increased supply of water to Edinburgh are now practically complete, and will be opened with some ceremony towards the end of this month. The works were begun ten years ago—September, 1895—and include an embankment across the Talla water, 1,200 ft. long and 90 ft. above the river bed, also a conduit leading to Edinburgh thirty-five miles in length, nine miles of which consist of tunnel, and twelve miles of cut and cover aqueduct.

A notable gift on the educational side is that made by Mr. E. G. Bawden through Mr. Edgar Speyer. The total sum devoted to philanthropic and educational needs is £100,000, and Mr. Speyer had a free hand in the allocation of this amount. The largest single donation is that of £16,000 to complete the sum of £200,000 to bring about the incorporation of University College in the University of London, the scheme in connection with which, as our readers will remember, has already received the necessary official sanction.

CONTENTS.

Sixteenth Annual General Meeting at Manchester of the Institution of Mining Engineers.

The annual general meeting of the above institution will open in the Lord Mayor's parlour, Town Hall, Manchester, at 11 a.m. on Wednesday, when the sixteenth annual report will be read.

The following papers are down for reading:—"Leading Features of the Lancashire Coalfield extended," by Mr. Joseph Dickinson, F.G.S. "Up-to-date electrical power distribution," by Mr. Robert Loraine Gamlen. "Can Explosions in Coalmines, with their associated toxic fatalities, be prevented," by Mr. B. H. Thwaite. "Earth in collieries, with special reference to the recently issued departmental rules," by Mr. S. F. Walker. "The value of Mollusca in coal-measure Stratigraphy," by Mr. J. T. Stobbs, F.G.S.

The following papers will be open for discussion: "The firing of Babcock and other boilers by waste-heat from coke-ovens," by Mr. T. Y. Greener. "The compound winding-engine at Lumpsey Mine," by Mr. M. R. Kirby. "The electrical driving of winding-gears, supplementary note," by Mr. F. Hird. "The education of mining engineers in the United States," by Professor Howard Eckfeldt. "An outline of mining education in New Zealand," by Professor James Park. "Goaf-blasts in mines in the Giridih coal-field, Bengal, India," by Mr. Thomas Adamson. "The Conveyor-system for filling at the coal face, as practised in Great Britain and America," by Messrs. W. C. Blackett and R. G. Ware. "Underground horses at an Indian Colliery," by Mr. Thomas Adamson.

In the afternoon there will be a reception of the members by the Lord Mayor of Manchester (Sir Thomas Thornhill Shann), and in the evening a dinner in the banqueting hall at the Midland Hotel.

Thursday, Friday and Saturday will be devoted to excursions of which a very varied programme has been arranged. The first excursion scheduled for Thursday, September 14th, will be to Chanters Colliery and Douglas Bank Colliery, while members who prefer to do so, will have an opportunity of visiting New Moss Colliery and the Lancashire Electric Power Company's Works. In the evening at 6.30 p.m. an inspection will be made of the valuable collection in the museum at Manchester University tea and light refreshments being provided, at the invitation of the Manchester Geological and Mining Society. During the visit, Mr. George H. Winstanley the lecturer in mining to the university, will deliver a short address explaining the scheme of mining education, adopted in the newly established department of mining, which provides for concurrent practical training at local collieries.

On Friday, September 15th, excursions are available for the British Westinghouse Electric and Manufacturing Company, Ltd., Works and the Manchester Ship Canal, docks, etc. Another excursion provides for a visit to the works of Messrs. W. T. Glover and Co., Ltd., and of the Trafford Light, Power and Supply Company, in additon to the ship canal, docks, etc., while a third available excursion covers the Manchester Municipal School of Technology, the Manchester Art Gallery, the Royal Exchange, and the Manchester Corporation Stuart Street Electric Generating Station.

An excursion of exceptional interest is reserved for Saturday, when members will visit Pendleton Colliery. An inspection will be made of the surface arrangements and the workings in the Ramsmine—the deepest in England.

New Coal Measure.

Over thirty years have elapsed, says "Commercial Intelligence," since there has been so important a development of the Black Country coalfield as is now in progress at Himley, Staffs. It is nine years since drilling operations were commenced there outside the then recognised limits of the thick coal deposits, and after a year's work carboniferous rock was struck, which clearly indicated the presence of coal measures of great value. The sinking of a shaft was then resolved upon; and in July, 1902, a seam of coal, 2 ft. thick, and of splendid quality, was reached at a depth of 530 yards. The sinking was accompanied by enormous difficulties, due to the water-bearing strata of the ground, and it became necessary to line the shaft with powerful hoops of iron as the work progressed. The second shaft at Himley is now being sunk, and the plant and general equipment of the new colliery will be on a scale never equalled before in the Black Country. Mining experts look upon the discovery as a new coalfield altogether, and not as an extension of the old one, and its store, according to present indications, is likely to outlast a century of active work. A valuable 5 ft. seam of coal has also been struck at Cwmmawr colliery, Llanelly, the quality of which is said to be excellent, and it will be developed immediately, while a well-known North of England firm is acquiring some valuable seams in the Mold district on which work will also be begun shortly.

The Society of Motor Manufacturers and Traders has voted a sum of £500 to the legislative fund of the joint committee of the Automobile Club and the Motor Union appointed to prepare evidence for the purposes of the Royal Commission on the Motor-car Acts.

A Spark Arrester for Locomotives.

In a paper read recently before the Midland branch of the Institution of Mining Engineers by Mr. William Maurice, he describes an invention which has been designed to prevent the emission sparks from locomotive chimneys.

The device consists of a vertical cage composed of a series of bars arranged in a circle. The bars are set at varying angles, in such a manner, in order that the products of combustion from the furnaces may strike against them and are diverted before they pass into the direct updraught. Any sparks that may be carried are intercepted and fall to the bottom of the cage. This cage is fitted between the bottom of the smoke-box and the base of the chimney. Fig. 1 is a section through the smoke-box of a locomotive showing the spark-arrester in place. Fig. 2 is an elevation of the spark-arrester viewed from the opposite side to fig. 1; and fig. 3 is a sectional plan.

The spark-arrester is shown in two parts, each consisting of end flanges or plates, A and A^1; the flanges A^1 being bolted together to form the complete cage. Between the flanges are fixed vertical bars, B, which, as shown more especially in the plan, are placed at varying angles to a radius of the cage affording channels between them for the free entrance of the hot gases.

The front blade, B^1, is set, for convenience, at right angles to a radius, as is also the larger double blade, B^2, fitted at the side next to the ends of the fire-tubes.

It will be noticed that the hot gases, coming from this side, cannot directly enter the tubular cage, but meet the faces of the blades, B and B^2; consequently, any sparks carried with them are caught, and fall to the bottom of the smoke-box, C, within which the cage is secured.

An arrester of the type described was applied to a colliery locomotive about four months ago. Previous to the application of the arrester, sparks and fine cinders were frequently emitted from the chimney. They report that neither dust nor sparks now escape, and it is noticed that the coal consumption per ton-mile averages about 10 per cent. less than before. It is probable that this latter result has been brought about by the arrester causing more uniform distribution of draught.

It is known that certain of the locomotive tubes always became choked, and required much more cleaning than others, whereas each tube now seems to be doing its share of the work, and all are cleaner at the end of a shift than they were before the arrester was used.

British Enterprise in Bohemia.—Revival of the Gold Industry.

The amount of gold produced in Bohemia in the year 1904 was 89·0951 kilos, as against 7·877 kilos, for the previous year; this increase, says a consular report just issued, was due to the fact that the Mount Roudny gold mine, a British undertaking, commenced crushing on September 1st last year. This mine is situated not far from the important market town of Beneschau, which is one hour by train from Prague on the Imperial State Railway to Vienna. Equipped with a battery of 30 stamps, 100 tons of ore are treated per day of 24 hours, giving an average of 7 to 8 dwts. of gold per ton of ore. The free gold is caught on the amalgamation tables, pyrites containing gold are separated on the concentration tables and are sent to Freiberg in Saxony, where they are smelted, the tailings are treated in the cyanide works at the mine, and the total extraction is from 80 to 85 per cent. From September 1st, 1904, to June 30th, 1905, about £40,000 worth of gold has been delivered to the Imperial Mint at Vienna. A second mine at Krasna Hora, which is also a British venture, will commence work this month with a plant capable at first of treating 50 tons of ore per day Mining claims have been taken up by British, French and local companies, and the gold mining industry, which for so many years lay dormant in Bohemia, bids well to become one of some importance, and will give employment to many miners who were discharged last year by the closing of the Imperial silver mines at Kuttenberge. One of the principal advantages of mining in this country is that a good supply of cheap labour is always available.

FIG 1.

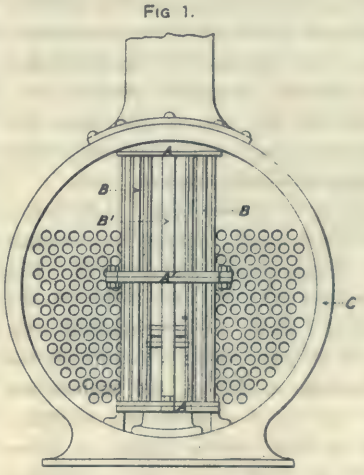


FIG. 2

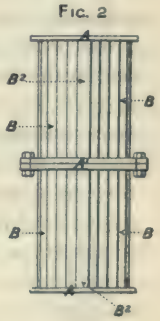
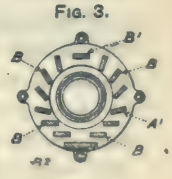


FIG. 3.



SPARK ARRESTER FOR LOCOMOTIVES.

Motor-car Commission.

The following is the constitution of the newly-appointed Royal Commission on the Motor-car Acts:—Viscount Selby (chairman); the Marquis of Winchester; Sir David Harrel; Sir William Bower Forwood, Chairman of quarter sessions of the county of Lancaster; Mr. Edward Richard Henry, C.V.O., C.S.I., Commissioner of Police of the Metropolis; Mr. William John Mure, C.B.; and Mr. Horace Cecil Munro, C.B., one of the assistant secretaries of the Local Government Board. Captain Charles Clive Bigham, C.M.G., is nominated secretary. The Commissioners will report as to (1) The working of the Motor-car Acts, 1896 and 1903, and of the regulations under them; (2) The law and practice in relation to motor-cars in the principal foreign countries; (3) What amendments, if any, should be made in the Motor-car Acts and the regulations under them; (4) The injury to the roads alleged to be caused by motor-cars; and (5) Whether any, and, if so, what, additional charges should be imposed in respect of motor-cars, and how any money thus raised should be applied.

American Shipping.

A report issued by the United States Bureau of Navigation shows that 1,054 vessels of 263,064 gross tons were built in the States and officially numbered during the year ended June 1905, a decrease of 38 vessels, representing 86,509 gross tonnage, as compared with the year ended June, 1904.

The announcement that the Metropolitan line of New York, now a branch of the Eastern Steamship Company, has awarded a contract for two mammoth turbine steamers for its service between Boston and New York has occasioned considerable interest in steamship and transportation circles. The contract is one of the largest in the shipping line ever entered into in the United States, and involves an expenditure of over $2,000,000. The contract for the hulls has been awarded to Roach's Shipyard, Chester, Pa., and William F. Fletcher and Co., of Hoboken, has the contract for the machinery, while the joiner work will be done by Charles N. Englis, of New York.

The steamers are to be 400 ft. long, 51 ft. beam with a flaring guard 6 ft. wide, making the breadth over all 63 ft. The depth of hold will be 23 ft. The introduction of turbines into the new boats is the most important feature. They will be equipped with the Parsons type of turbines, and, according to the Marine Review, the construction of the engines will be directly under the supervision of the inventor. Each will be driven by three turbine engines of 11,000 h.p. each. Each vessel will have three propellers making 500 revolutions a minute, driving the vessels through water at the rate of twenty-four miles an hour. This will enable the steamers to make the run between Boston and New York in fifteen hours, leaving here at 5 p.m. and arriving at New York at 8 o'clock the following morning.

The Iron and Steel Institute.

By the courtesy of the committees of the Sheffield Conservative and Unionist Club, and of the Sheffield Reform Club, the privileges of honorary membership will be extended to members of the Iron and Steel Institute during their forthcoming meeting.

An arrangement has been made with the Great Western, Midland, Caledonian, London and North-Western, Great Northern, Lancashire and Yorkshire, Great Central and other railway companies to furnish tickets to Sheffield from London and provincial towns at a single fare and a quarter, available from September 23rd to September 30th.

Mr. Andrew Carnegie, the ex-president of the Institute, will not be able to attend the meeting. It is improbable that the Institute will make any visit abroad in 1906, but the usual spring meeting in London is to be followed by another in the summer, when the Institute will entertain the American Institute of Engineers, who acted as hosts to the British visitors to the States last year.

Wages Disputes and Special Courts.

In the course of the proceedings at the Trades Union Congress this week a resolution was adopted to the effect that "this congress is of opinion that special courts should be created to deal with summonses concerning wages due, fines deducted, and breach of agreement on the line of the Continental Trade Courts; such Courts to be composed of a judge and elected representatives of the employers and employees."

A "Congress Internationale d'Expansion Economique Mondiale" is to be held at Mons on the 24th inst. its object being to discuss economic problems.

A general meeting of the Birmingham and District Electric Club will be held to-morrow evening at the Colonnade Hotel, New Street, and will be of a social character, a musical programme having been arranged.

Subscribers to the National Telephone Company's system in London since the 1st inst. have been able to use the Anglo-French and Anglo-Belgian telephone services on the same conditions as Post Office subscribers. Similar facilities will also be available to the company's subscribers connected with the main exchanges in the provincial towns with which communication is practicable.

WIRELESS TELEGRAPHY.

BY SIR WILLIAM HENRY PREECE, K.C.B.

THE inception of ætheric telegraphy in 1884 and the various stages of its progress in Great Britain were regularly reported by me to the British Association up to 1896, when Mr. Marconi appeared and succeeded in capturing the enthusiasm of the press and the public by his wonderful experiments. The first practical results obtained by the Post Office with the Marconi system on Salisbury Plain were reported by me to the British Association at their Liverpool meeting in 1897. Since then its progress has been slow but satisfactory, and it is gradually attaining the practical stage.

USE IN THE RUSSO-JAPANESE WAR.

Much has been done to fit up ships of war with plant for ætheric telegraphy for warlike purposes, and the war between Russia and Japan has brought it into great prominence. Not only has it been in use on all ships of war of all nations in the Far East, but it has maintained communication between Port Arthur and Chifu during the greater part of the siege. The Times, also, with great enterprise and spirit, chartered a steamship, the *Haimun*, fitted her up with "wireless" plant of the De Forest type, established a well-equipped shore station near Wei-hai-wei, and transmitted much news to Printing House Square by Eastern Telegraph cable; 2,000 uncensored words were one day sent across 180 miles of sea at a mean speed of 30 words a minute, and thence 14,010 miles to London, where they were printed in The Times the next morning with marvellous accuracy. The experiment was too successful, for it showed a power of anticipating movements that might prove seriously detrimental to the success of strategic operations. The Japanese, as well as the Russian Government took prompt measures to stop the practice.

The Japanese are well equipped with stations on their own shores and along the coast of Corea, and upon all their ships. All the British men-of-war in the China seas are fitted up. The Italian Government work also between Tsin-wan-tau and Chifu.

I have no authentic information of this means of communication having been used for land operations by the respective armies. The ordinary field telegraphs are at present more practical.

IN THE POST OFFICE.

Our Post Office, where wireless telegraphy originated in 1884, and where Mr. Marconi received a warm welcome and much encouragement in 1896, has been persistently experimenting and testing all new systems, improvements and novelties. It has an experimental line between Holyhead and Howth, near Dublin, 59 miles across, where some classical researches have recently been conducted. Admirable results have been achieved. But while the system has at last advanced to a practical stage, and it is undoubtedly capable of useful service, it cannot yet compete in reliability and efficiency with the ordinary telegraph. It is an over-sea system and not an over-land one. It can be used over land, but not with certainty or reliability.

The Post Office has developed a system of diplex working, by which two messages can be sent in the same direction at the same time, and it has also been measuring with great accuracy the strength of the signals received, from which many useful conclusions have been drawn. Mr. Duddell has devised a new thermo-galvanometer by which this has been possible. Very successful experiments have been made by him and Mr. J. E. Taylor in Bushey Park as well as in the Irish Channel. We have now the means to measure the strength in micro-amperes of the minute currents received, the energy absorbed, the length of the waves employed, their persistence and their damping, and every detail of work at each end of a circuit, with an accuracy equal to that attained in any other engineering or scientific operation. This is aways regarded as the final stage of any practical application of science to useful purposes.

WAR DEPARTMENT USES.

The War Department has also been persistently experimenting with different systems. The experimental apparatus sent out to South Africa and Somaliland were lamentable failures. This was due, probably, to the dryness of the earth in those two countries. An experimental line has been worked between Elmers End, in Kent, and Aldershot, and capital experiments, at which I assisted, were made last autumn in Wales across the Snowdonian Range, proving that mountains were not serious obstacles.

SIR WILLIAM H. PREECE, K.C.B., F.R.S.

Whose address on Wireless Telegraphy proved to be one of the most interesting items in the South African programme of the British Association.

Very valuable experiments in this direction have been made by the United States Army Engineers under Major Squier, which show that the most serious obstacles to good signals are living trees and tropical vegetation. Every tree is a leak. It absorbs energy from the electric waves and weakens the signals. It can be used as an antenna. A forest is thus much more an enemy to wireless telegraphy than a mountain range.

THE CABLE COMPANIES.

The immense excitement created by the transmission of signals across the Atlantic in 1902 led to a panic among the holders of stock in cable enterprises. I expressed great doubts at the time of the reliability of the reports published of the success of the working across the Atlantic. These doubts were justified. Nothing practical has yet been attained. On the other hand, the cable companies have recognised that wireless telegraphy may be used to supplement their own systems as feeders. They have also fitted up several of their repairing ships, for, by having shore stations at their landing places, they can facilitate their own repairing operations very much indeed.

IN THE ADMIRALTY.

The Admiralty have been equally persistent in their inquiries. Every commissioned ship is fitted up. The system used is Marconi's improved by Captain Jackson, R.N., and others. They have paid the Marconi Company £20,000 for their patent rights. Captain Jackson, the Controller of the Navy, anticipated Mr. Marconi, and has certainly placed our navy in the van of all navies in the use of wireless telegraphy. Captain Jackson read a paper before the Royal Society in May, 1902, to which I shall have to refer when I write about the disturbances to wireless telegraphy.

LONG DISTANCE TELEGRAPHY.

The Marconi Company have been continually experimenting upon their long-distance trans-ocean system. They have not yet established permanent communication across the Atlantic. Signals have been sent from Poldhu, in Cornwall, to Cape Breton in North America, and recently to Iceland, and also to Bari in Italy, on the Adriatic, a distance of 1,000 miles. The company have fitted up about 60 of the mail steamers and liners of different nations. Passengers by some of these boats are enlivened by the receipt and transmission of messages en route across the Atlantic. Newspapers are published on board, and the latest news is received from land stations and from passing steamers of the different lines. This appears to be a commercial transaction on the part of the Marconi Company, and not an expenditure on the part of the shipowners. The company fit up the ships, take the receipts and transact the business.

The company has entered into a working agreement with the post office. Messages are now received by that department anywhere, and are sent for ocean work to the company's shore station at Poldhu The *Caronia*, *Campania*, *Umbria*, *Etruria* and *Lucania* are so fitted up specially. Cunard ships are occasionally receiving messages from each shore simultaneously, but they can send messages only to one side owing to the apparatus on board ship having a range of working not exceeding 260 miles in favourable weather.

These ships, as well as many French, Dutch, German and Belgian steamers, are also fitted, and messages can be sent to them for 6½d. per word with a minimum of 6s. 6d. from the Marconi shore stations at the North Foreland, Niton (Isle of Wight), Lizard, Rosslare (Ireland), Crookhaven and Malin Head.

APPLICATION TO LIGHTSHIPS.

Arrangements are being made to fit up the following lightships, *East Goodwin*, *South Goodwin*, *Cross Sand*, *Gull*, *Tongue* and *Sunk*. The installation of Marconi wireless telegraph apparatus at Sable Island and Halifax (Nova Scotia),, under contract with the Canadian Government, has just been completed, and these two stations are now working. Similar stations at Whittle Rocks and Cape Rich are being erected, and are probably now in operation. The effective range of other Marconi stations is being increased, so as to provide a complete inter-station service between the following stations on the Canadian and Newfoundland coasts; Fame Point, Heath Point, Cape Ray, Whittle Rocks, Cape Rich, Point Amour, Belle Island, Cape Race, Halifax, Sable Island. This service will take the place of the land-line service along the shores of the St. Lawrence, as the latter is frequently interrupted by bad weather and the breaking of the cable by ice floes.

Lloyd's have also established the system at their own signal stations at Browhead, Fastnet Rock, Malin Head and Irishtrahull, on and off the coast of Ireland, and they have working arrangements with the Marconi Company at Niton, Rosslare, North Foreland and the Lizard. This is primarily for the purpose of reporting the passing and arrival of ships and for the conveyance of orders to them.

An interesting use of the system occurred in Harrow on June 30th last, when the King and Queen opened the new playing fields. As reported in the Daily Graphic the Royal Standard was broken and the detonating rocket fired, both by Her Majesty the

Queen, from the pavilion on the school terrace at a distance of over a mile, by wireless telegraphy. There was no waiting squad of cadets; to the solitary flagstaff alone was the message sent. It was carefully explained to their Majesties what would happen on the electric button being pressed, and it was with the greatest interest that both of them fixed their eyes on the distant flagstaff. The Queen pressed the button, and with a scarcely appreciable interval the standard was seen to break. "There she goes!" cried the King, and the answering rocket boomed "Hurrah!" The Queen's pleasure at the incident was unmistakable, and it was, without a doubt, a unique and most interesting ceremony.

FOREIGN PROGRESS.—GERMANY.

In Germany great progress has been made. When in 1897 a report reached Berlin of the experiments the Post Office was making in the Bristol Channel, the Emperor sent over Prof. Slaby, of Charlottenburg, to inspect and report upon what was doing. We gave Prof. Slaby every facility, and he witnessed our experiments. He returned home much enthused, and having every facility placed at his disposal for experiment, he, with Count D'Arco, Prof. Braun and the chief German electrical houses, Siemens and Halske, and the Allgemeine Electricitäts-Gesellschaft, have developed a system in Germany equal in every respect to those which have been developed in Great Britain. In that country all rivalry has ceased, for all interests are amalgamated into one concern "Gesellschaft für drahtlose Telegraphie." Assisted by their pushing and active commercial spirit they assert that they have installed as many, if not more working systems than all the other nations put together. They have fitted up 450 complete installations, including ships. The American, German, Russian, and nearly all other navies but ours and France have been supplied by them, and they have many ship-signalling stations and shore stations fixed. All the principal War Departments in Europe have also been supplied with their military equipment. This company has installations in Argentina, Austria-Hungary, Denmark, Sweden, Norway, Holland, Russia, Spain, Portugal, Turkey, Mexico, Siam and Tonking, but they are principally coast stations and lightships as well as plant for military and naval purposes. They are now erecting a large station having a range of 360 miles near New Orleans to communicate with 23 stations erected by them along the coast. In no instance have they erected a circuit for commercial telegraphy. They offer to erect and guarantee their communication.

FRANCE.

In France no great development has taken place, but their navy is fully supplied, and they have established between Dieppe and Newhaven a circuit which is used to further the boat traffic between the London, Brighton and South Coast Railway and the Chemin de Fer de l'Ouest. The system used is a modification of Marconi's. Ducretet, Morse, Popoff, and Branly (the inventor of the coherer) have been very active in developing a French system, but I am not aware of any new improvement.

UNITED STATES.

In the United States there has been great development. The two principal systems, besides that of Marconi, are those devised by Fessenden and by De Forest. The latter system has gained much reputation from its selection by The Times for its great experiment in the Far East already referred to. I have mentioned that their navy is gradually being equipped with the German system, but from St. Louis during the recent exhibition they established the De Forest system in connection with Chicago, 300 miles away. The general condition of business is very much as it is here.

Many prominent points on the coast are, however, occupied by four or five different interests. These are the New York Herald Company, the Marconi Company, the De Forest Company, the Fessenden Company, and the Pacific Wireless Telegraphy Company, together with the Army Signal Corps, the Navy, the Department of Agriculture, and the Department of Commerce and Labour. There are a great many stations fixed and many more contemplated, but the executive has stepped in, and on the recommendation of a very strong committee they are putting the whole question of wireless telegraphy, as we have done, under the proper control of a Government department. The naval coastwise service is already well organised, and the service for casualties, storm warning and for communications to and from ships is free. There are 26 stations installed and at work.

ITALY.

In Italy they have, of course, supported Mr. Marconi. Their ships on commission are all equipped and they have many shore stations. They have established a circuit between Bari and Antivari across the Adriatic. It is interesting as being the first international commercial "wireless" circuit opened to the public. It is at Bari that signals have been received from Cornwall. A high-power station is being equipped at Coltano, near Pisa, whence it is

hoped to communicate with Argentina. The Sicilian railways have a communication across the Straits of Messina.

INDIA

In India successful communication has now been obtained by the Lodge-Muirhead system between the Andaman Islands and Burmah, across 300 miles of sea. This will lead to their permanent connection with the mainland.

METEOROLOGICAL SERVICE.

In July last the Daily Telegraph proposed that arrangements should be made for data concerning the weather conditions to be collected on board all the trans-Atlantic steamers fitted with Marconi apparatus on the incoming or eastward voyage for three days before coming into touch with the land stations. The information is compiled by the captain or one of the ship's officers, and transmitted by the wireless system to our shore stations, and published in the Daily Telegraph. The Government meteorological office in London is now in communication with the Company, with a view to arrangements for a similar service as an aid to the office in compiling its weather reports.

FUNDAMENTAL FEATURES.

In every wireless telegraphic circuit we have to consider

The sending station A.
- i. The source of energy.
- ii. The transmitter.
- iii. The antenna (*a*).
- iv. The air and æther.

The receiving station B.
- v. The antenna (*b*)
- vi. The receiver.
- vii. The earth.

A is the sending end, B is the receiving end when A is speaking to B. This arrangement is reversed when B speaks to A.

Waves are rhythmic disturbances of a medium which may be solid, liquid, gaseous or ætheric. They are motions due to the impression of some force upon the medium. They vary in form, frequency and speed according to the nature of the energy exciting them, to the medium conveying them and to the resistance opposing them. Sound, heat, light and electricity in transit are undulatory forms of energy. We are going to deal only with electricity and its transference by waves through the æther or by currents through matter.

These electric waves are of two kinds, electromagnetic and electrostatic. They are set up by the rising and falling of every current of electricity when intermittent or alternating. They move at right angles to each other, and to their direction of propagation. They oscillate with a well-defined frequency, and the lengths of the waves are very easily determined. These lengths in practical wireless telegraphy vary between 100 ft. and 3,000 ft., and tuning means regulating the waves so that at each end they are of the same form and frequency. When this is the case we obtain the maximum strength of signals.

The fundamental features of this mode of telegraphy is the formation of sparks. Hence in Germany it is called "spark telegraphy." A spark is a sudden transformation of energy produced in an air-gap when the air is broken down by an excess of voltage; 30,000 volts are required to break down ¼ in. length of air. It is the simplest known mode of producing very sudden discharges, but by the use of mercury vapour another and perhaps better method is under investigation. Lightning is a spark due to the action of some millions of volts. A spark throws the electric system in which it is formed into vibration, and the rate of this vibration depends on the capacity present holding the charge of electricity and the counter E.M.F. set up by the self-induction in the system due to the motion of this charge. As the notes of a tuning fork are regulated by the length of the prongs and the elasticity of the material of which they are made, so the notes set up by a spark are regulated by the capacity of the system and the electromagnetic inertia (inductance) of the circuit. In fact, if we express the value of the capacity and the inductance in centimetres, which we can do, twice the square root of their product gives the length of the waves, or

$$\lambda = 2\sqrt{KL},$$

and if we are dealing with a simple aerial wire whose length is l

$$\lambda = 4l$$

SOURCE OF ENERGY.

The source of energy was originally a primary battery. It then became an accumulator. Now for long distances it is either an oil, gas or steam engine. At Poldhu 40 h.p. steam engines were, I believe, installed, but the Marconi Company are about to instal 240 b.p. in their new trans-Atlantic shore station. For ordinary distances up to 50 or 60 miles, 3 to 5 h.p. oil engines are quite big enough.

TRANSMITTER.

The transmitter is a mode of generating sparks which set up in the antenna and thence in the æther trains of electric waves that can be regulated so as to have a definitive frequency and die off at a definite rate. Experience has shown that the best effects are produced when we use short, fat, snappy explosive sparks. Such sparks excite the largest amount of energy in the antenna, and this is the chief object to be attained.

Rounded rods give better results than knobs, and the separation of the air space into five or six sections with an equal number of sparks gives excellent results. The distance crossed and strength of signals received depends on the amount and form of energy flung into the æther in the form of electrical waves. It is when the waves sent by the one and those received by the other antenna are tuned to the same frequency to the same rate of decay and are of pure form that we obtain the maximum strength of signals and the best rate of working. This tuning is the whole essence of practical working.

THE ANTENNA.

The antenna was originally a single wire supported by a tall mast, but it is now either an inverted pyramid or a network of wires. Each system has its own peculiar form of antenna, but there is no new principle involved in any of them. It is, however, found by experience that they need not be so tall as they were originally, for the length of wave can be regulated by condensers and inductance coils, and also that the best effects are obtained by regulating the length of wave to the distance to be traversed. It is, however, quite certain that the length of the antenna must depend on the length of the waves desired, but they have to be supplemented with condensers and inductance for tuning. Major Squier remarks, with regard to living trees: "The earth's surface is already generously provided with efficient antennæ which we have but to utilise." Simple wave measures are now supplied that are of great use for tuning.

The distance of transmission at sea between ships is not constant. It may vary considerably owing to the state of the atmosphere. Thus a variable source of energy is imperative even at fixed stations, and there should in all cases be a factor of safety of at least 1 to 3. The distance to which we can signal varies directly as the energy transformed into waves, and there is strong reason to believe that to moderate distances over sea it follows the linear law, that is, the currents received diminish in intensity inversely as the distance. In fact, it has been distinctly shown by the British Post Office experiments in the Irish Channel that within the distances experimented over, the product of the current and the distance is constant.

The loss of energy is considerable in the transmitting system. Of the 240 h.p. to be used on this side of the Atlantic, only a very small fraction of a single horse-power will be utilised on the other side of the ocean. Much is lost in heat in the wires and in the sparks, much leaks into the air and much more into the earth, especially, when working over land. Thus the useful work done by that which strays into space and reaches the receiving station is something very small indeed. It is measured and expressed in microwatts. Fair signals are produced by 50-millionths of a watt!

THE ÆTHER.

It is the æther that, permeating the air that is disturbed by the antenna, radiates away in electric waves the energy from the transmitter in every direction, only a fraction of which is picked up by the other antenna at the other station. If it were not for tuning, every station would be interfered with; but now tuning is so well understood that only those stations in tune are affected by each other. There are an infinite number of frequencies for tuning. The Germans have adopted four standards for:—

1. Commercial ships signalling.
2. Cruisers.
3. Torpedo boats.
4. Admiralty service.

An international congress is about to be held in Berlin, where one of the most important questions to be decided is this of recognised and standardised tuning. It is clear that for commercial, life-saving and danger-warning purposes some universal and uniform system is essential, but for different navies each nation will adopt its own. Secrecy at present is to be obtained only by codes. Wilful interference is difficult to prevent, but mutual agreement can reduce actual interference to a minimum, if not eradicate it altogether. The international conference has been postponed from time to time owing to the war. It cannot he held until international matters are more settled.

RECEIVING APPARATUS.

The antenna at the receiving end must be the counterpart electrically of that at the sending end. It requires a sensitive relay—called a coherer or responder—capable of being influenced by the very delicate currents transformed from the impact of the electric waves in the æther upon the exposed wires of the antenna. This relay actuates a Morse machine, or a Kelvin recorder, or a telephone. The last is the most rapid and the most general. Marconi's original coherer was of the Branly pattern, but it has become obsolete. Castelli, of the Italian Royal Navy, very much improved this, and Marconi adopted it for a time, but he has since developed a magnetic detector, based on a principle introduced by Rutherford, which is more sensitive and more reliable, and can act as a relay to work a recorder. It is in use by the British Admiralty. It is also quicker, and has given a speed

of 24 words per minute between Amsterdam and the Marconi experimental station at Chelmsford.

"Lodge's" coherer is an excessively beautiful, simple and practical instrument. A thin steel disc just slightly rotates in a layer of oil covering a bath of mercury. The disc is one part of the receiving circuit, and the mercury the other. They are insulated from each other by a fine film of oil. The voltage excited in the circuit has just sufficient force to pierce this film of oil, form a current, and excite the telephone. The Germans use two relays, the one a granular coherer of the Branly type, and the other an electrolytic cell of the Schloemilch type.

The De Forest "responder" has two electrodes separated by an electrolyte through which a local current passes. The impacts of the electric waves upon the antennæ produce currents which polarise the electrodes and affect the telephone, which is used as a receiver. The speed of reading has been much enhanced; 35 words per minute have been read.

THE PART PLAYED BY THE EARTH.

The earth completes the circuit, and nearly all the past failures have been due to our ignorance of its true function. It is thought that because the sea acts so much better as a conductor than the land, that so little difficulty has been found when working over sea. It is believed that because the dry land is a non-conductor that such failures took place in South Africa and Somaliland. Moisture is essential to good earth. It is usual to make direct contact with the earth by burying small plates of copper, but with such minute currents as those received by the antenna the plate should be large to avoid the ill effects of polarisation. A flat piece of wire netting laid on the ground or near the ground is as good and sometimes better than a buried plate. It acts as a capacity. The Lodge-Muirhead system adopts this for military purposes from its simplicity and rapidity of installation, and it is also used by Dr Slaby in Germany. It is even maintained by Dr. Muirhead that the use of the earth is deleterious and that we can do better without it. Major Squier has shown how much living trees leak away the energy. There is no doubt that better working for short distances is ensured by large capacities raised above the earth. This may be due to a better regulation of the quantity of electricity flowing and to the formation of a purer form of sinuous wave. It certainly facilitates tuning, but the earth cannot entirely be dispensed with. The average British electrician has not yet had his faith shaken in the part played by the earth as developed by Faraday, Maxwell and Kelvin.

DISTURBANCES.

However beautiful and complete the apparatus may be, there are disturbing influences at work that seriously interfere with the constant and reliable working of a "wireless circuit." I have referred to bad earths; we have also bad atmospheres. There is a great difference in the strength of signals sent by day and by night, especially observable when working long distances in bright sunny weather and in dull cloudy skies. Sunlight abstracts from the waves much of their energy by ionisation, for it makes the air a partial conductor. High land, trees, houses, material particles, like sand, salt, water globules, act in the same way. Hills reflect the waves, sometimes away to their ion, sometimes back together again. Atmospheric electricity is the worst enemy, for it sends false signals and even letters of the alphabet. It diminishes the distance to which signalling is possible. Captain Jackson found that the distance for fine weather signalling is reduced by lightning from 30 to 70 per cent. There are daily periodic disturbances caused by "atmospherics"—a term used to denote active currents due to atmospheric electricity—in the early morning and evening and the afternoon. They are very variable and very troublesome, especially in the tropics.

CONCLUSION.

"Wireless" telegraphy is really still in its experimental stage. Great progress has been made and will continue. The sea is its domain. Here it is practical and even commercial, but not reliable for continuous periods or for long distances. It has not yet been proved effective over land, excepting for comparatively short distances where the earth is moist and rivers abound. There are very few places where it can compete financially with telegraphs and telephones, and it would be folly to apply it for telegraphic purposes where simple wires can be erected and telegraphs and telephones employed. It is not even cheap, for though the capital expenditure is smaller, the working expenses are greater and the speed of working less. Every case must be considered on its merits. In all cases it is a question of £ s. d. An engineering system that utilises only one billionth of the energy it generates is scarcely practical economics, though it may for vital purposes be of inestimable value. Where, however, one end of the circuit is in motion like a ship or an advancing army, or when a city is beleaguered there is no question of its value. For war purposes wireless telegraphy is imperative, whatever its cost.

Read before Section G (Engineering) of the British Association at Johannesburg.

SIR WILLIAM CROOKES, F.R.S., ON DIAMONDS.

SIR WILLIAM CROOKES, F.R.S., in the course of a lecture on "Diamonds" before the British Association, remarked that from the earliest times the diamond had fascinated mankind. It had been a perennial puzzle "one of the riddles of the painful earth." Of late years the development of electricity, with the introduction of the electric furnace, had facilitated research, and if the diamond problem was not solved there was every probability that it shortly would be solved. He had studied diamonds scientifically for thirty years, and in 1896 spent nearly a month at Kimberley collecting facts connected with the birth of the precious stone. After giving a detailed description of the Kimberley mines, and pointing out that the five mines were all contained in a precious circle 3½ miles in diameter, Sir William said that before the discovery of the mines there was nothing in the superficial appearance of the ground to indicate the precious treasures below. Since the filling of the volcanic ducts with diamondiferous ground, denudation had planed the surface, and the upper parts of the craters and other ordinary signs of volcanic activity being smoothed away, the superficial and ubiquitous red sand had covered and disguised the whole surface.

Other diamondiferous pipes in the neighbourhood were small, and did not contain stones in payable quantities. Hoards of diamonds might await the lucky discoverer, but there were no surface signs, and as the pipe itself was hidden under ten or twenty feet of recent deposits, prospecting was a matter of sheer speculation. How the great pipes were originally formed it was hard to say. They were certainly not burst through in the ordinary manner of volcanic eruption, since the surrounding and enclosing walls showed no signs of igneous action, and were not scattered and broken up even when touching the "blue ground." It was pretty certain these pipes were filled from below after they were pierced, and the diamonds were formed at some previous time and mixed with a mud volcano, together with all kinds of debris eroded from the rocks through which it erupted, forming a geological "plum pudding." It might be that each volcanic pipe was the vent of its own special laboratory—a laboratory buried at vastly greater depths than they had yet reached—where the temperature was comparable with that of the electric furnace, where the pressure was fiercer than in our puny laboratories and the melting point higher, where no oxygen was present, and where masses of liquid carbon had taken centuries, perhaps thousands of years, to cool to the solidifying point. The chemist arduously manufactured infinitesimal diamonds, valueless as ornamental gems; but nature, with unlimited temperature, inconceivable pressure, and gigantic material, to say nothing of measureless time and appalling energy, produced without stint the dazzling radiant, beautiful, coveted crystals he was enabled to show them. After describing the processes by which an infinitesimal diamond might be artificially manufactured, Sir William Crookes, dealing with the meteoric theory, said he was enabled to show photographs of true diamonds he had himself extracted from the Canyon Diablo meteorite. A fine slab of the meteorite was on the table. Here they had incontestable proof of the truth of the meteoric theory. At the same time, although in Arizona diamonds, had fallen from the skies, this descent of precious stones was what might be called a freak of nature rather than a normal occurrence. It was certain from observations he had made, corroborated by experience gained in the laboratory, that iron at a high temperature and under great pressure—conditions existent at great depths below the surface of the earth—acted as the long-sought solvent for carbon, and would allow it to crystallise out in the form of diamond. But it was also certain, from the evidence afforded by the Arizona and other meteorites, that similar conditions have existed among bodies in space, and that on more than one occasion a meteorite freighted with jewels has fallen as a star from the sky.

Many circumstances pointed to the conclusion that the diamond of the chemist and the diamond of the mine were strangely akin as to origin. The lecturer concluded with a survey of the chief chemical and physical characteristics of the diamond illustrating his remarks by a number of highly interesting experiments. He showed the effects of radium upon a diamond. Some fine colourless crystals of diamond, he said, were embedded in radium bromide, and kept undisturbed for more than twelve months. They were then examined, when it was found that the radium had caused them to assume a beautiful blue colour, and their value as "fancy stones" had been materially increased. The diamond was remarkable in another respect. It was extremely transparent to the Rontgen rays, whereas highly refracting glass, used in imitation diamonds, was almost perfectly opaque to the rays. By this means imitation diamonds could be readily distinguished from true gems.

ELECTRIC POWER SUPPLY IN YORKSHIRE.

THE NEW THORNHILL POWER STATION.

THE new Thornhill station of the Yorkshire Electric Power Company is situated between the London and North-Western Railway Company's Ravensthorpe Station and the River Calder, the position being chosen with due regard to its proximity to a railway and water supply, as tending to keep the cost of working as low as possible.

Powers were granted to the company in 1901 to supply electrical energy over practically the whole industrial portion of the West Riding—an area of 1800 square miles. It is estimated that in this area there are steam engines in use of a total horse-power of 3,000,000. The power users in the area may be classified as follows :—Local authorities (bulk supply), railways, tramways and canals, textile factories, collieries, engineering works, and miscellaneous. A demand for power has sprung up from all these classes.

The company have already made agreements with Pudsey Corporation and with the Urban District Councils of Mirfield, Birstall, and Liversedge. They are at present supplying the first two, and we are informed that various other local authorities are also negotiating with the company for a supply.

The networks of tramways extending over the company's area is unequalled. Tramways are authorised in an unbroken line from Knottingley to Todmorden, from Ilkley to Honley, and they are practically all driven electrically. Railways are also steadily electrifying their lines, and the canals present a good case for electrical driving. From these various sources a large demand for power is anticipated.

GENERAL DESIGN OF STATION.

The station is a steel and brick structure, divided into two parts ; the boiler house 70 ft. by 80 ft., the engine house 100 ft. by 50 ft.

The design of the station is such that the capital cost per kilowatt is reduced to a low figure without sacrificing security or efficiency in any way. Extensions will be made as required by adding to the present station (which is in itself two complete unit stations) similar " units " until a total capacity of some 60,000 h.p. is reached. Plans of the power station will be found on page 506.

THE BOILER HOUSE.

Coal may reach the station by road, rail, and river. By road the coal is delivered to a hopper outside the boiler house, and is raised from thence to the boiler house bunkers by means of a bucket conveyor ; the railway siding (not yet constructed) will feed the same conveyor, which will raise 25 tons of coal an hour.

The coal bunkers at the top of the boiler house are of steel, and from these coal is delivered through automatic measuring shoots to each boiler. Provision is made for six boilers, of which four are already installed ; they are of the water-tube type, made by Babcock and Wilcox, each capable of evaporating 20,000 lb. of water per hour from a temperature of 60 F.

THE SUPPLY AREA OF THE YORKSHIRE ELECTRIC POWER COMPANY, SHOWING THE LOCATION OF THE THORNHILL POWER STATION AND THE THREE OTHER STATIONS SCHEDULED IN THE ACT.

to steam at 160 lb. per square inch pressure, and 150 F. superheat. Each boiler has a heating surface of 5,730 square feet, and a grate area of 100 square feet. The chain grates and stoker gear are worked by electric motors. The ashes fall by gravity to the basement, and are delivered into trucks. The main flues, of which there are two, are beneath the boilers, and lead to two brick-lined steel chimneys 150 ft. high and 10 ft. diameter. The economical combustion of coal is watched with great care, daily tests being made of the heat value of the coal used, the composition of the flue gases, and everything bearing on the boiler efficiency.

The arrangement of the steam and feed-water piping is designed so that one-half of the boiler house can be completely isolated from the other. At the end of the boiler house are situated the feed-pumps, hotwells and water-tank, immediately under the control of the boiler house staff; these feed-pumps are the only auxiliaries which are not electrically driven.

THE ENGINE HOUSE.

This, like the boiler house, has a main floor and basement; it is designed to contain generating plant of 8,450 kilowatts (11,000 h.p.) capacity. Two turbo-alternators, each of 2,000 kilowatts, are already installed, and a third is being erected. Three high-speed Allen engines direct connected

to direct-current dynamos of 150 kilowatts each are installed at the end of the engine room; these machines provide the current necessary to operate the station motors and for a local supply.

The main generating sets are Curtis turbo-alternators made by the British Thomson-Houston Company, Ltd., of Rugby. These turbines have vertical shafts with the alternators mounted on top—an arrangement which enables a large amount of power to be housed in a small building. The shaft and all rotating parts are carried by a hydraulic footstep bearing; water at a pressure of 400 lb. to the square inch is supplied by three-throw motor-driven pumps, and the shaft floats on a film of water. The top and centre bearings of these machines are lubricated by the gravity system, with oil at a pressure of 10 lb. per square inch pumped from a settling tank in the basement into a tank at the top of the engine house, from which it gravitates to the bearings and returns to the settling tank. These pumps, and indeed, all the auxiliary machinery in the station, are excellent examples of the adaptability of electrical driving to varied uses.

The turbine runs at a speed of 1,000 revolutions per minute, and is controlled by a centrifugal governor. This governor by an electrical controller operates small steam valves opening or closing the passages to the steam nozzles as the load varies.

CONDENSERS.

A separate surface condenser is provided for each turbine, and the general arrangement presents some novel points. The condenser tubes are vertical; the air-pump running at 160 r.p.m. is direct-coupled to a motor, and the circulating water discharge pipe being submerged at its end in the river, allows the syphon action of the arrangement to be taken advantage of, and thus reduces very considerably the head against which the water is pumped. The syphon action is maintained by means of

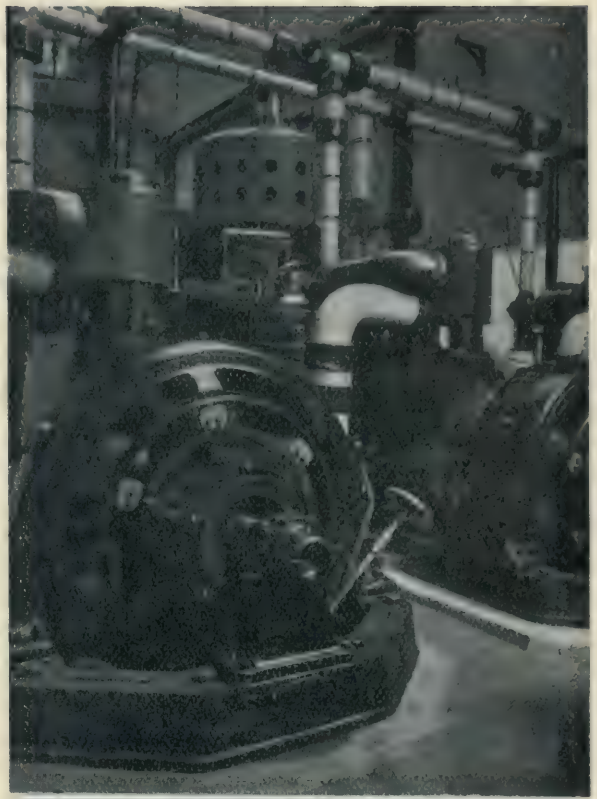


FIG. 1. A CORNER OF THE ENGINE ROOM AT THORNHILL POWER STATION.

FIG. 2. EXTERIOR OF THE STATION.

a dry-air pump, which prevents an accumulation of air in the pipes and condensers.

The centrifugal circulating pumps in the basement are controlled from the main floor; each pump is rated to lift 160,000 gallons per hour against a head of 28 ft.

The proportionately large size of the condensing plant is on account of the benefits to be obtained by working with a high degree of vacuum in connection with steam turbines; the results obtained with the present plant point to an extremely low consumption of steam per kilowatt hour.

An electrically operated travelling crane travels the whole length of the engine house; it is equipped with three motors, one for each motion.

The alternators attached to the turbines generate three-phase alternating current at 10,000 volts, at which pressure it is transmitted to the various sub-stations. The switch-gear controlling the machines and transmission mains, which is constructed by the British Thomson-Houston Company, is of the type that experience has proved suitable to controlling large powers at high voltages. It occupies three floors of one side of the engine house, and is thoroughly fireproof. Each part is separated from the remainder by a brickwork partition, and can be disconnected when required without affecting the working of the other parts.

The large amount of space occupied by the switch-gear and considerations of safety call for a central control of all operations. There is, therefore, a control switchboard situated on the switch gallery. From this switchboard the whole of the main switch-gear is operated by means of low-pressure current. All the high-pressure gear is enclosed, and the main switches, of the oil-break type, are worked by means of small motors. The switchboard attendant on closing a small switch causes the motor to open or close the main switch; directly the operation is performed the motor stops automatically, and a lamp lights up informing the attendant of the fact. The paralleling of the alternators is also performed on the control board, the speed of the turbines being regulated by a small switch operating a motor attached to the governing gear of the turbine.

No high-pressure current is brought near the control board. The instruments showing the pressure and current in each feeder are all controlled by low-pressure current, a maximum of convenience and safety being thus obtained. The switch-gear for the direct-current machinery is also on the switch gallery.

TRANSMISSION MAINS.

The high-pressure cables, which were supplied and laid by Messrs. Callender's Cable and Construction Company, Ltd., are led from the power station in earthenware ducts for a considerable distance until they diverge in different directions, when they are laid in wooden troughs. Each cable is covered by a lead sheath and steel wire armouring, and contains three copper conductors insulated from one another and from the sheath by paper insulation. The cables are tested to three times the working pressure or 30,000 volts before being laid.

The accompanying illustrations, together with the plan and elevation on page 506, will serve to give a general idea of the scope of the plant and the company's operations. Next week we shall have something to say about the application of power in the huge district under consideration.

THORNHILL SUBSTATION.

This substation, which is for the purpose of giving a low-pressure supply to Thornhill and Ravensthorpe, may be taken as typical of the company's transforming substations where direct current is required. The greater part of the electrical energy is, however, supplied by the company as three-phase alternating current.

(*To be continued.*)

SHIPBUILDING NOTES.

The large steel-screw steamer *Clan Macpherson* was launched on Friday, September 1st, by Messrs. Furness, Withy and Co., Ltd., Hartlepool. She has been built to the order of the "Clan" Line (Messrs. Cayzer, Irvine and Co.), Glasgow, and is over 400 ft. in length. She is of the three-deck type, with two steel decks laid all fore and aft, and takes Lloyd's highest class, the scantlings being considerably above their requirements. She has a total capacity of 431,718 cubic feet; cellular double bottom all fore and aft, and specially-strengthened deep tank immediately forward of the engine room; the after-peak being also available as a tank. The vessel is divided into eight water-tight compartments by means of seven bulkheads. A complete system of ventilation is arranged throughout the ship. She has five large hatchways, ten powerful steam winches, large multitubular donkey boiler, twelve derricks, powerful steam windlass, patent steam steering gear fitted under bridge; girders, and wide spaced pillars fitted in holds in lieu of stanchions, leaving the holds clear for taking in large cases of machinery, etc., etc. Special attention has been paid to the arrangement of derricks to enable cargo being discharged with great rapidity, and one 30-ton derrick is fitted up for dealing with heavy weights. The vessel will be lighted throughout by electricity by the builders, and fitted up as a first-class cargo steamer. The captain's and officers' accommodation, with spare state-rooms are arranged in a steel deckhouse on the bridge deck with separate house at after end for engineers, the seamen and firemen being berthed in the poop, and the petty officers in the forecastle. Triple-expansion engines will be supplied by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, with cylinders 26 in., 43 in., 71 in., by 48 in. stroke, The two boilers 16 ft. 2 in., by 11 ft. 9 in. working at a pressure of 200 lb., are fitted with Howden's forced draught. The christening ceremony was performed by Miss Annette Furness. Mr. A. B. T. Cayzer and Mr. J. Lyall were present on behalf of the owners.

The s.s. *Lestris* was launched by Swan, Hunter and Wigham Richardson, Ltd., on Thursday afternoon, the 31st August. This steamer has been built to the order of the Cork Steamship Company, Ltd., of Cork, for their trade between Liverpool and Dutch and Belgian ports. The steamer is 260 ft. in length by 34½ ft. beam, and will have accommodation for a limited number of passengers. She is being built to attain the highest class in Lloyd's register. The triple-expansion engines and the boilers, are also being constructed by Swan, Hunter, and Wigham Richardson, at their Neptune Works. Amongst those present at the launch were Mr. Pike, the chairman of the Cork Steamship Company, Captain Hore, of Liverpool, their marine superintendent, and Mr. J. A. Flockhart. of Liverpool, superintendent engineer. The christening ceremony was performed by Miss Jacob of Dublin.

On Thursday, the 31st ult., there was launched from the yard of the Tyne Iron Shipbuilding Company, Ltd., of Willington Quay-on-Tyne, a steel-screw steamer built to the order of Messrs. Franz Rahtkens and Co., of Middlesbrough, and of the following dimensions:—Length 350 ft., breadth 49 ft. 6 in., depth, moulded, 25 ft. 10 in. The vessel has been built to class 100 A1 at Lloyd's, with single deck laid and very long bridge. She has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharge of cargo, including six double-cylinder steam winches, direct-acting steam windlass, large donkey boiler, steam steering gear by Messrs. Donkin and Co., and Hastie's screw gear aft. The engines, which are to be supplied by Messrs. John Dickinson and Sons, Ltd., of Sunderland, are of the triple-expansion type having cylinders 24½ in., 41 in. and 67in., by 45 in. stroke, and working at a pressure of 180 lb. On leaving the ways the vessel was named the *Friederike* by Miss Friederike Rahtkens, daughter of the owner.

There was launched last week from the yard of the Caledonian Engineering and Shipbuilding Company of Preston, a paddle passenger and cargo boat, built to the order of Messrs. McCrea and McFarland, of Belfast and Londonderry for service on Lough Swilly, in connection with the North of Ireland Railways. The vessel's dimensions are 120 ft. by 20 ft. by 7 ft. 3 in., the compound diagonal surface condensing engines having cylinders 17 in. by 30 in., and working to a pressure of 120 lbs. Miss Irene Smith, daughter of the principal of the firm, christened the vessel *Lake of Shadows* in the presence of a large number of spectators. The Company are at present in the fortunate position of being full of work, having two large cargo boats, to build for the Amazon, a luggage boat for the Birkenhead Corporation, a large passenger boat for Sydney, a customs boat for Para and several other craft. They have also in hand New dock gates for the Whitehaven Harbour Commissioners.

On the 30th ult., Messrs. Workman, Clark and Co., Ltd., of Belfast, launched from their south yard a new steel screw steamer named the *Orator*, built by them to the order of Messrs. T. and J. Harrison, of Liverpool. The *Orator* is a vessel 365 ft. long, with a gross tonnage of about 3,750, and has been built under the supervision of Lloyd's surveyors for the highest class in their registry, also qualifying for a Board of Trade passenger certificate. The cargo space is divided by steel bulkheads into four holds, each of which has a large cargo hatch equipped with steam winches and derricks adapted for rapid handling of cargo. State-rooms with centre dining saloon for passengers have been arranged in a steel deck house on the bridge deck amidships, and rooms for officers and engineers are placed in wing-houses at the after end of the bridge deck. Accommodation for the crew will be fitted up in the top gallant forecastle. The engines and boilers have been constructed at Messrs. Workman, Clark and Co.'s engine and boiler works, Queen's Road, and consist of a set of triple-expansion engines with two double-ended and one single-ended multitubular boilers.

Last week Messrs. Harland and Wolff launched a large steel twin-screw steamer built to the order of Messrs. Bibby Bros. and Co., Liverpool, whose name has long been associated with shipbuilding on Queen's Island. The new vessel is 452 ft. long by 54 ft. beam. She will have four masts, schooner-rigged, and will be equipped with powerful steam windlass and winches, patent steering gear, and many novel contrivances for efficient working. She is intended to carry a large number of passengers, and ample provision will be made for their comfort, including mechanical ventilation of the state-rooms and baths. Refrigerators will ensure an ample supply of ice and fresh provisions, while the electric light will be provided throughout the ship. The new steamer will have two sets of Messrs. Harland and Wolff's quadruple expansion engines arranged on their latest "balanced" principle, which they have developed so successfully as to gain practical immunity from vibration. The new vessel is similar to the *Worcestershire*, built for the same owners last year, and, as in that vessel, a notable feature in the passenger accommodation is the arrangement of the state-rooms on the "Bibby" tandem principle, both the inner and outer state-rooms being lighted with sidelights from the outside. The advantages of this arrangement, which was first adopted in the s.s. *Warwickshire* of the Bibby line, are greatly appreciated by passengers, especially those travelling to the East.

Scottish shipbuilders have little cause to complain with the present year's business. The month of August has added 30 vessels of 62,042 tons to the previous total, making the eight months' total 206 vessels of 344,026 tons, figures which have been exceeded only once in the history of the industry—in 1901. Why the shipbuilding industry should continue so comparatively active while shipping itself continues dull is a point to which attention has been directed, and the explanation is rather far to seek.

In referring to the figures for August, special attention may be drawn to the large tonnage launched for Clyde owners. Altogether, ten vessels, aggregating 40,519 tons, were floated for Glasgow and Greenock registry; and when the big P. and O. liner *Mooltan* is deducted, as being scarcely Clyde-owned, though registered in Greenock, there is still left some 31,019 tons. Of this, 30,720 tons is made up by seven cargo steamers, running in size from 3,900 tons gross up to 5,100 tons. This is quite a large addition to the list of Clyde-owned vessels to be made within four weeks, and it proves that local shipowners have a firm faith in their own particular industry as a safe investment for their surplus capital. The majority of these new vessels were contracted for about the new year, when there was quite a rush of orders. Of the work then placed a great deal is yet to launch and some, indeed, is not yet laid down.

The vessels launched during August numbered 30, and made a total of 62,042 tons. This compares with 16 vessels of 22,124 tons last month, and 25 of 32,151 tons in August, 1904. The following are the district totals for the year to date:—

	Clyde.		Forth.		Tay.		Dee.	
	Ves.	Tons.	Ves.	Tons	Ves.	Tons.	Ves.	Tons.
Jan.	8	20,202	1	1,030	1	400	1	135
Feb.	12	42,499	2	510	1	4,300	—	—
Mar.	23	42,714	1	300	2	2,336	3	290
April	25	35,665	6	4,840	1	520	4	385
May	33	54,036	2	958	4	340	1	175
June	22	39,620	2	1,220	3	6,200	2	1,185
July	11	21,306	1	75	—	—	4	743
Aug.	23	58,055	4	1,185	1	2,300	2	502
	157	314,097	19	10,118	13	16,396	17	3,415

This gives a total for the eight months of 344,025 tons, compared with 267,663 tons last year, and 299,341 tons in 1903. In the boom year of 1901 the figures for the corresponding period reached a total of 354,826, while 1900 and 1902 were also good years with totals of 321,360 tons and 338,708 tons respectively. The lowest total recorded during recent years was 191,066 tons for the first eight months of 1893.

OUR WEEKLY BIOGRAPHY.

PROFESSOR HENRY ROBINSON, C.E.

(Professor Emeritus of Civil Engineering, King's College, London).

PROFESSOR HENRY ROBINSON was educated for the engineering profession at King's College, London, and became a Scholar in the Applied Science Department in 1856. The same year, after only two years' training, he was elected an Associate. In his case this honour carried with it unusual distinction, for three years, as a rule, must precede the associateship of King's College.

Photo, Elliott & Fry.

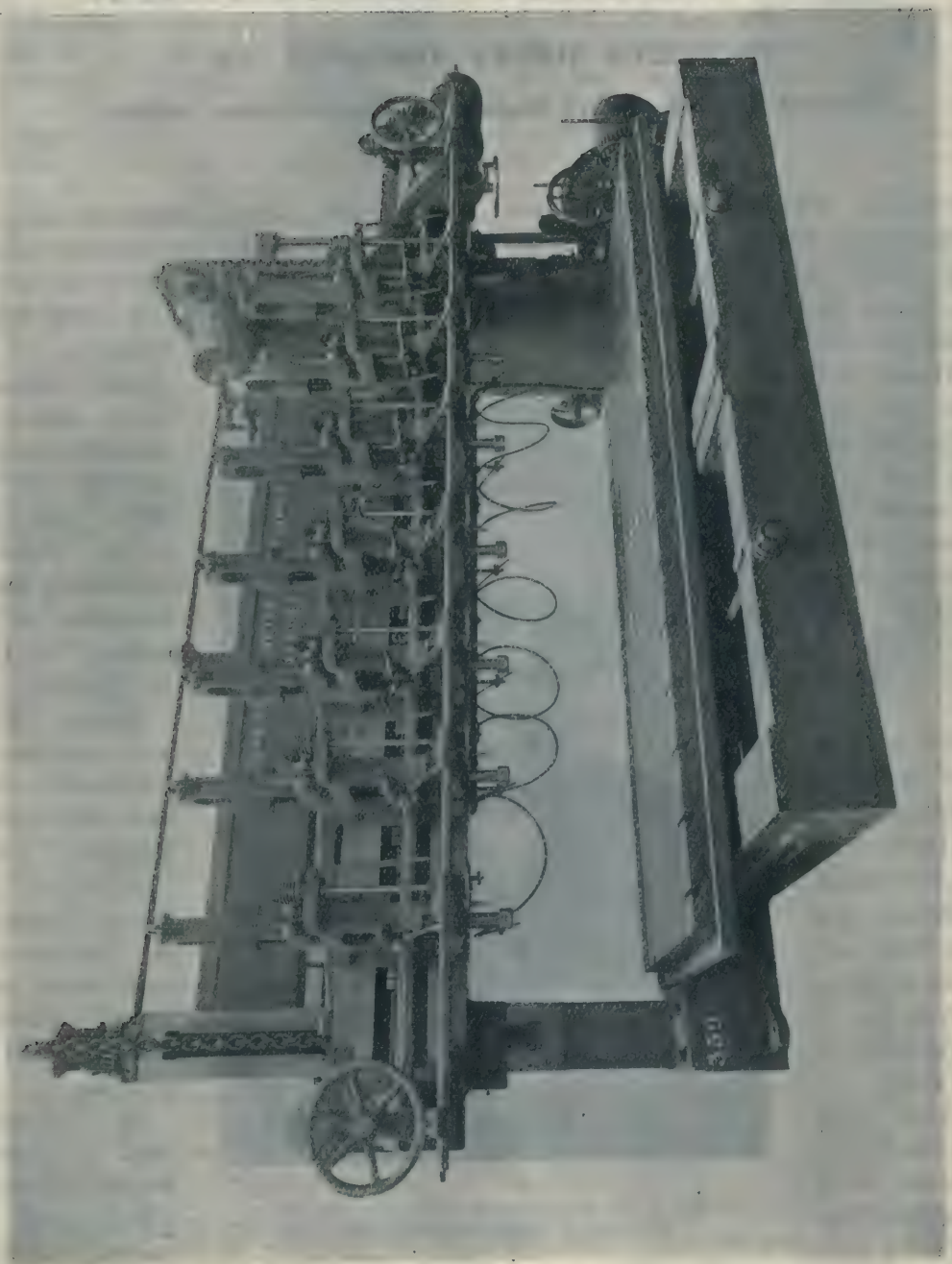
PROFESSOR HENRY ROBINSON, C.E.

For five years he was on the staff of Sir William (afterwards Lord) Armstrong, and assisted the Elswick firm both in their outdoor work as well as in the early days of the establishment of the gun works.

He then commenced practice in Westminster as a civil engineer, and during the last forty years he has carried out many works, including railways, water supply, electric lighting, sewerage, and sewage disposal. He is identified with many schemes for the distribution of power in towns by hydraulic power, compressed air, and electrical energy. He has matured schemes for the water supply of London by the construction of impounding reservoirs in valleys forming tributaries of the Thames, and has, in many papers and addresses, urged the necessity for the better conservation of the rainfall of the country and the prevention of the pollution of rivers and estuaries.

Professor Robinson's treatises on "Hydraulic Power and Hydraulic Machinery" and on "Sewerage and Sewage Disposal" are recognised as authoritative works by all students of this branch of engineering.

For twenty-two years he was a Professor in his old college, and the council created the Chair of Civil Engineering to give scope to his work there. On his retirement in 1902 he was elected by the council Professor Emeritus of Civil Engineering.



NO. 2 MULTIPLE DRILLING AND TREPANNING MACHINE BY JOHN HETHERINGTON AND SONS, LTD.

SEVEN-SPINDLE MULTIPLE DRILLING AND TREPANNING MACHINE.

BY JOHN HETHERINGTON AND SONS, LTD.

THE multiple drilling and trepanning machine illustrated on the opposite page is one of the latest machine tools produced by Messrs. John Hetherington and Sons, Ltd. The principal details of the machine may be summarised as follows: diameter of spindles $2\frac{1}{2}$ in., number of spindles or spindle slides 7, cones supplied for taper shank drills Nos. 1, 2, 3, 4, cones are suitable for twist drills ranging in diameter from $\frac{3}{16}$ in. to 2 in., to drill in diameter up to (7 holes at once) $1\frac{3}{4}$ in., to drill in depth up to 12 in., distance from centre of spindle to face of upright $19\frac{3}{4}$ in., maximum and minimum pitch of spindle centre 32 in. and 15 in., maximum width of plate which may be drilled 16 ft., diameter and length of drum or tube which may be drilled 5 ft. × 13 ft., table length and breadth (top faces) 5 ft. 10 in. × 15 ft., table traverse 6 ft., maximum distance from face of table to spindle nose 6 ft., uprights (width between) 16 ft., bed length and breadth over top faces 11 ft. 6 in. × 13 ft., bed depth $16\frac{1}{4}$ in., chucking arrangement for drum or flues, up to diameter and length, with Scott's or other approved dividing arrangement for pitching the holes on periphery, 5 ft. × 13 ft., diameter of pulleys and speed 36 in. × $9\frac{1}{4}$ in. : 368 in., approximate b.h.p. required 46, floor space required 14 ft. × 30 ft.

It will be noted that the bed is of strong box pattern. It is made in two halves jointed down the centre, stayed with box bars, and has two side projecting pieces or pockets to receive the uprights. A tank for lubricant is arranged in the bed. The table of strong well-ribbed section is provided with ⊥ slots planed from the solid. A drain-trough runs round the outer edges to carry lubricant back to the tank. The table is fitted with hand and power traverse in both directions by means of separate pulley driven at a constant speed. The hand lever is placed in front of the machine, a large hand-wheel being also conveniently placed for the operator.

The cross slide, with strong deep box back, is balanced by chains, pulleys and weight. It is elevated and lowered by power by open and cross belts, worms, wheels, square thread steel screws and gun-metal nuts.

The carriages or spindle slides are accurately fitted to front face of cross slide with adjustable setting-up strips. Each one, or any combination, can be adjusted or traversed along the cross slide by power by means of an independent drive, giving a constant speed, or by hand from either end of cross slide by means of two hand-wheels. Each slide can also be adjusted or traversed independently.

The machine has hard steel-balanced spindles, sliding in long cast-iron sleeves, which revolve in conical bearings. Each spindle may be stopped and started instantaneously by clutch and lever. The spindle noses are fitted with Muir's patent coupling and coned bushes for readily securing and releasing drills, etc.

The feed motion is common to all spindles, independent, self-acting, variable, positive and continuous by three-speed change gear, actuated by indexed hand-wheel. The feed of each spindle can be instantaneously started or stopped independently whilst the machine is in motion, and each spindle is fitted with an independent slow and quick hand adjustment.

Dividing or pitching motion to the table and spindle slides is by means of indexed gun-metal

discs, conveniently placed one for the table and one on each end of the cross slide, thus enabling the spindle slides to be adjusted from either end. The discs 5¼ in. diameter give 1 in. per revolution and are divided into 64 divisions. As the discs revolve slowly, the lines being wide apart ($\frac{8}{16}$ in.), and the adjustable finger being moved back to zero each operation, the task of pitching the spindles along the cross slide or table is reduced to a minimum.

Driving is by means of four-speed cone pulley of large diameter, two quick changes of spur gear, alongside the cone pulley, actuated by clutch and lever, friction clutch reverse motion, vertical shaft, mitre, and spur gear on to shaft in cross slide which is of special steel and large in diameter, each spindle being coupled by mitres and cut steel spur gear well guarded. The slow speed rotary pump is connected to tank and large supply pipe on the underside of cross slide with independent connections and tap to each spindle. Each is fitted with a universal joint arrangement carried on an inverted column attached to each spindle slide, enabling the jet of water to be directed in any required direction. The trepanning head consists of cast-iron body arranged to bolt on underface of spindle slide. The front face is provided with vees and is fitted with cast-steel slide adjustable by hand-wheel, square thread screw and mitre wheels, and fitted with revolving ball-bearing bush for putting the pressure on the hardened cast-steel centre for steadying the cut. The slide is also fitted with hard steel spindle or double cutter head, having a taper shank to suit spindle nose.

ELECTRICAL POWER IN EGYPT.

THE German Consul at Alexandria dea's in a recent report with the use of electricity for various purposes in Egypt. In Cairo we find that lighting current is generated by a station which the gas company controls, but the public light.ng is not developed as yet, and only private lighting is operated. A tramway system is working in the city and is owned by a Brussels company. Alexandria is using current for private lighting but, like Cairo, has no public system. The tramway lines are controlled by an Egyptian company. To connect Alexandria with its eastern suburbs a concession has been granted to the Alexandria and Ramleh Railway, which has lately adopted electric traction on the lines. The same English company are now operating the city tramway lines.

Port Said now has an electric lighting system, which is newly installed, but there are no electric tramways. At Mansourah, the public and private lighting is conceded to an English company for twenty years, dating from 1899. At Suez the concession for the electric lighting in the town and also at Port Tewfik was given to H. Beyts and Co., in 1902, but has now passed into the hands of the Ismailiah Electric Company.

It seems likely that gas engines will be used to a considerable extent in Egypt in the future. Motive power is employed almost exclusively for irrigation. The most common type of machine is the portable locomotive, of English construction. On one plantation a Siemens-Schuckert electric plant gives power for motors. Prince Djemil Tussum has also adopted a German electric station on his property for the same purpose. It will be remembered that the gates of the celebrated Assouan dam are operated by Siemens-Schuckert electric motors. There is some question of using the cataracts of the Nile as a source of hydraulic power to operate electic plants and distribute current throughout a region which is now a desert, but which would flourish it the Nile water were taken through it. Thus the river would provide the irrigation water and also the motive power. This project, however, is one which remains for the future to solve.

ROLLER-BEARINGS.

By Thomas W. How, F.R.G.S.

The present divergence of opinion as to the practical application of roller-bearings to movable and fixed machinery is attributed to their limited application and consequent trials, to the expense of re-fitting existing plant, and to the difficulty of obtaining comprehensive data of economies effected.

The requirements of a satisfactory roller-bearing are that the various parts must be proportioned with reference to their relative movements, and constructed of materials suitable to withstand the stresses imposed upon them. For heavy loads the author recommends high-class finish and hardened steel, but for light loads milder steel of good quality, with due regard to load in each case.

The efficiency of roller-bearings largely depends upon true parallelism, proper spacing of rollers, and proportionate diameter, length, and hardness of the rollers, in order to withstand fatigue.

Of the various contrivances for spacing the rollers the author regards the "Empire" floating cage as the most satisfactory, owing to its simplicity of construction and easy adjustment.

Solid rollers are advocated rather than spiral, hollow, or rollers threaded on spindles. Provision for end-thrust or lateral movement of a roller-bearing is necessary, and several methods are described.

The author, whilst contending that roller-bearings should be produced at reasonable cost, regards first cost as secondary to ultimate economy in motive power measured by savings in coal or electrical current per annum, and lubrication.

Recent tests on line shafting electrically driven fitted with roller-bearings effected a saving of 24·4 per cent. of the power required to run the motor and counter-shaft with machines in full work.

Earlier unsuccessful experiments made with roller-bearings are attributed to causes now well understood and avoided, such as excessive rigidity and improper load adjustment, which are now obviated by means of swivel seatings so that the load is evenly distributed.

Examples are given of roller-bearings successfully applied to the axles of coal-weighing shoots, each bearing supporting a load of 5 tons on 8 rollers on mild steel axles where the total tractive resistance was reduced to 3 lb. per ton of load.

In tramway and railway vehicles a series of tests has also proved the starting effort to be 3 lb. per ton of load, giving a co-efficient of friction of 0·0013, including wheel friction upon straight, level rails. This reduction effected a saving in electrical energy equal to 50 per cent. of journal friction, equivalent to ½d. per car mile, or £50 per car per annum.

On the Birmingham electric tramways a saving of 24·30 per cent. of tractive force per ton of load was obtained, and a saving of 1·035 units per trip, equivalent to £38 16s. 3d. per car per annum.

At Southport the average energy consumption of roller-bearing cars was 0·55 units per car mile with a mean speed of 10·3 miles per hour, as against one unit per car mile with ordinary bearings, and a mean speed of 8·6 miles per hour. The *mean* current consumption with ordinary bearings was 0·797 units per car mile, and with roller bearings 0·389, showing a saving of 0·408 units per car mile, or a saving of £68 per car per annum.

As examples of railway tests, the earlier trials on the London, Brighton and South Coast Railway are cited, where, after six years' service, and 120,000 miles' run, a saving of 12½ per cent. was shown in coal consumption.

On the Indian State Railways a saving of 12·36 per cent. according to coal consumption, and 11·76 per cent. according to water consumption, was effected, or a mean of 10 per cent., equal to a saving of 135 tons of coal per train per annum, or £67 10s. per train of six coaches. Taking the life of the roller bearing at ten years, and allowing for sinking fund and interest on the capital cost of the bearings for that period, the annual charge per train is only 0·56 per cent. of the actual economy effected, plus the increase of traffic obtained by longer trains without any appreciable increase in the expenditure of energy.

On the Liverpool Overhead Railway, roller-bearing tests proved that the reduction per ton mile of coal consumption was equal to 9 per cent., and that longer trains could be employed.

On the Northern of France Railway the tests proved a saving in tractive resistance of 6 to 1 in favour of roller-bearings, at speeds varying from 50 to 75 miles per hour.

The reduction of tractive resistance and the correspondingly diminished wear and tear of materials combined with increased comfort in smooth, easy running, the smarter handling of trains, the acceleration of speed, and the increase of carrying loads by means of successful roller-bearings, are subjects well worth the careful consideration of engineers.

Abstract of a paper read before the British Association.

TENDER ENGINE, 1904, FOR NATAL GOVERNMENT RAILWAYS. TOTAL WEIGHT OF ENGINE AND TENDER, 106 TONS 14 CWT.

THE DEVELOPMENT OF THE LOCOMOTIVE DEPARTMENT OF THE NATAL GOVERNMENT RAILWAYS.

By Sir David Hunter, K.C.M.G.

(*Continued from page* 463.)

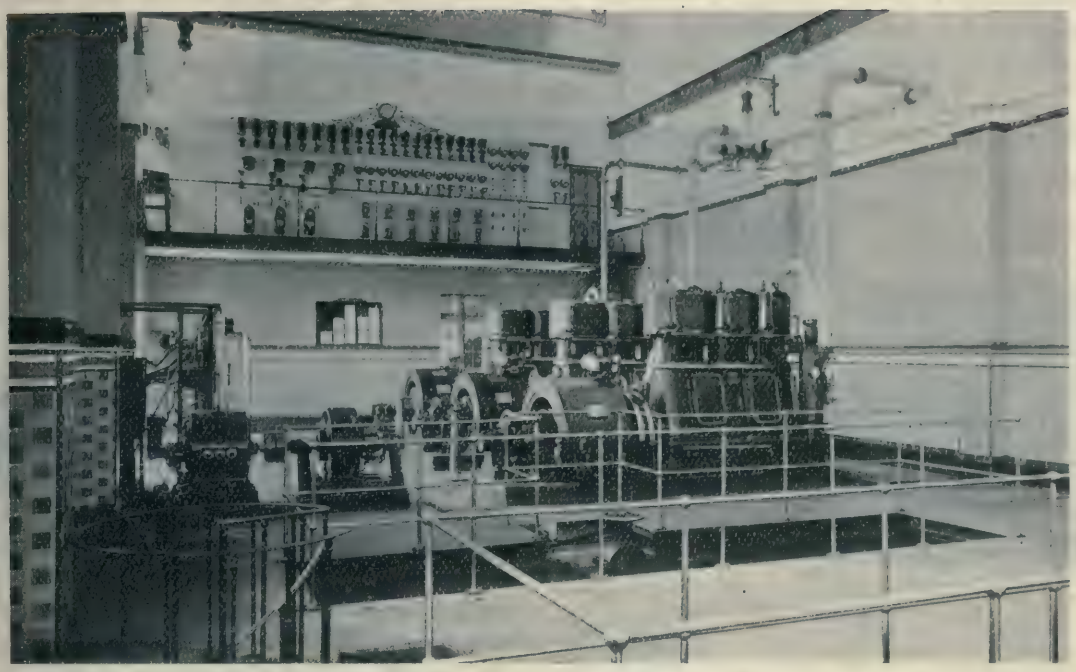
ELECTRIC POWER STATION.

SEVEN years ago the electrical department was commenced on these railways for the purpose of train lighting, and the lighting of Durban yard and buildings. About three years ago, when it was decided to rebuild the workshops, the management resolved to adopt electric power. In consequence of this decision, a central power station and plant was designed, and is now completed and in operation, supplying all the power for shop purposes, in Durban and Greyville, and also all the lighting of the various buildings and offices.

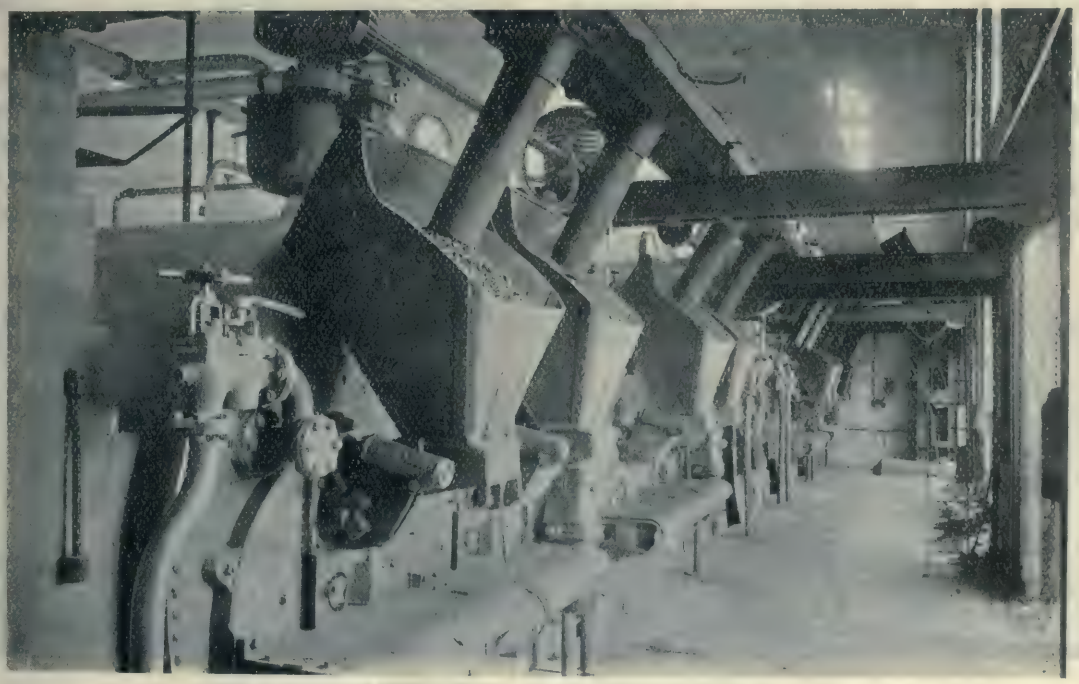
The boiler house is 118 ft. long by 50 ft. wide, and contains five Lancashire boilers, each having an evaporating capacity of 15,000 gals. per hour. All the boilers are mechanically fired by Bennis and Co.'s stokers, in conjunction with overhead coal and ash-handling plant, coal and ash elevators being erected outside boiler room, and all material being thus automatically handled from trucks on adjacent sidings. Situated in the centre of the present battery of boilers, is Davey, Paxton and Co.'s separately-fired superheater, with which the steam is heated 100 deg. The working pressure of boilers is 160 lb., and they are completely protected by means of the latest design of high and low-water alarms, automatic steam regulators, duplication of safety valves, etc., etc.

The feed heater is supplied through a Green's economiser of four batteries, and tubes and feed lines are in duplicate.

The engine room is 118 ft. long by 35 ft. wide, and contains at present three 225-kilowatt



INTERIOR OF POWER STATION AT THE DURBAN LOCOMOTIVE AND CARRIAGE WORKS.



THE BOILER PLANT, SHOWING BENNIS STOKERS IN OPERATION.

HIGH-SIDED WAGON.

CAPACITY, 33 TONS.

ROYAL MAIL VAN AND TENDER.

N.G.R. CORRIDOR SLEEPING CAR.

Bellis-Peebles generators. The engines are triple expansion, and aggregate 1,000 h.p., superheated steam being used. Provision has been made in this building for extension up to 5,000 h.p. The generators are compound-wound six-pole machines, 210 volts. The main switchboard is located at the end of the building, and is approached by an iron staircase from the floor. From the platform in front of the board a full view of the engine room is obtained. The board was made by Kelvin and James White, Ltd., and contains five generator panels and nine distribution panels, with two circuits to each panel. At present there are only nine distributing feeders connected; these supply the various departments with power.

In the basement in centre of engine room are located the pumps, condensing plant, etc., and outside is a Worthington cooling tower with a motor-driven fan. On the floor of the engine room is a 30-kilowatt motor-generator,

N.G.R. BOGIE WAGON, CARRYING CAPACITY 35 TONS.

supplying the engine-shed depot, two miles away, with three-phase current at 2,000 volts, which is there transformed down 200 volts for lighting and power purposes.

ELECTRIC DRIVING.

The power station supplies all the railway departments with electricity. There are at present installed and in course of erection, some 280 motors of sizes varying from 1 h.p. to 60 h.p. All new machinery is ordered from home, ready equipped with motors, and being designed for electric driving there is no difficulty about speed regulation. The old machines that were in use previously and which had to be provided with motors presented some difficulty, as they were, of course, not designed for electric driving.

The method used for these tools is a system of multi-voltage. A balancer giving five different voltages and these old pressures to suit the speed required. The whole of the works are being fitted with motors and in a few months' time, with the exception of the boilers for the steam hammer in the smiths' shop, there will be no other separate steam plant in the works other than the Central Power Station. The maintenance department workshops are fitted entirely with motors. In the traffic department large Gantry cranes and capstans have been imported for use in the goods sheds.

In the head offices are three lifts worked electrically. Between the carriage shop an electric traverser is in use, capable of dealing with the largest stock. The central power station and all subsidiary works in connection with the undertaking have, by their successful operation, proved to the management their wisdom in adopting electricity as the motive power for the whole works, both on the scores of economy and increased efficiency.

RAILWAY STOCK.

With reference to the railway stock, the Natal Government commenced in a small way, and a portion of the early stock is still in existence, although its doom is sealed, and ere many months elapse it will be consigned to the scrap-heap.

The principal running depots are at Greyville (two miles from Durban), Pietermaritzburg, Ladysmith, and Charlestown.

The sheds at Durban and Pietermaritzburg are of modern construction, and are similar in design. The Ladysmith and Charlestown sheds are now too small, and the matter of provision of new ones is under consideration.

	Tare.	Carrying capacity.	Gross load.	Percentage of tare to gross load.	Ratio of paying freight to gross tonnage.	Proportion of net load to tare.
6-ton capacity :						
4-wheeled stock—	T.C.	T.C.	T.C.			
Low-sided	3·10	6·0	9·10	36·84	63·65	1·71
High-sided	3·14	6·0	9·14	38·14	61·85	1·62
12-ton capacity :						
6-wheeled stock—						
Low-sided	7·13	12·0	19·13	38·9	61·07	1·56
High-sided	7·16	12·0	19·16	39·39	60·60	1·53
20-ton capacity :						
8-wheeled stock—						
High-sided	10·13	20·0	30·13	34·75	65·25	1·87
24-ton capacity ..	11·13	24·0	35·13	32·68	67·32	2·06
30-ton capacity :						
8-wheeled stock—						
High-sided	15·4	30·0	45·4	33·63	66·37	1·97
35-ton capacity :						
8-wheeled stock—						
High-sided	16·10	35·0	51·10	32·04	67·96	2·12
High-sided (new)	14·1	35·0	49·1	28·64	71·35	2·49

The carriage and wagon stock employed on the Natal lines is on the most approved modern principles; first and second-class coaches, luxuriously upholstered with lavatory attachments being available by most trains. Twenty, thirty, and thirty-five tons capacity steel wagons are in general use, and in connection therewith the above comparative table will be found interesting.

JOINT INVESTIGATION INTO THE METALLURGY OF STEEL.

IT is reported that an international committee for investigating the constituents of steel has been formed at the instance of Professor R. T. Glazebrook and M. H. le Chatelier. The objects of the committee are to undertake the researches with the object of arriving at authoritative conclusions, and of drawing up a common system of nomenclature.

The following memorandum drawn up by M. le Chatelier was issued by Dr. Glazebrook when the matter was first mooted, in order to clear the way for preliminary work :

PRELIMINARY INVESTIGATIONS AS TO THE CONDITIONS UNDER WHICH QUENCHING SHOULD BE PERFORMED.

Before studying the properties of the constituents of steels, it is necessary to define precisely the conditions under which each of them can be obtained. The constituents as to which there exists the most uncertainty are those of quenched steels. Distinctions have hitherto been made between these based chiefly on metallographic characteristics. Accordingly, preliminary experiments to ascertain the conditions of production of these constituents will be principally those of quenching, followed by metallographic examination of the quenched metals.

The preliminary investigations will doubtless involve the use of a considerable quantity of metal and it does not seem to be indispensable, at any rate at the outset, that they should be made everywhere upon the same specimens. It will be less costly for each laboratory to take steel specimens to which it has access. In this way a strain will not be put upon the goodwill of works to whom it will be necessary to apply for large quantities of metal for the final experiments.

The preliminary studies may be divided into two parts :—(1) Study of the conditions of the production of austenite. This should be taken by itself on account of the special difficulties it presents and of the more complicated method of procedure it will demand. This question is the first to take up, for it appears probable that all the constituents of steels are derived from a series of transformations of austenite. (2) Study of the conditions of production of the other constituents of quenched steels.

STUDY OF THE CONDITIONS OF PRODUCTION OF AUSTENITE.

According to present knowledge this constituent is obtained the more easily the more carbon the metal contains, the higher the temperature to which it is heated, the lower the temperature of the bath in which it is quenched. On the other hand this constituent is very rapidly destroyed by heating to 150 deg. C. and perhaps slowly at the ordinary temperature. In any case one and the same specimen, if polished several times, gradually alters its appearance. This result may perhaps be due to two causes—either the heat generated by polishing, in spite of precautions that may be taken, or the mechanical action of rubbing.

The programme suggested is as follows :—

Steels with 1·4, 0·9 and 0·6 per cent. carbon.

Specimens of 20 millimetres ($\frac{4}{5}$ in. diameter, and of the following lengths :—2 millimetres ($\frac{1}{12}$ in.), 10 millimetres ($\frac{2}{5}$ in.) and 50 millimetres (2 in.).

The last named is to be notched to a depth of one millimetre ($\frac{1}{25}$ in.) to allow of its being split after quenching, in order to examine the central part of the cylinder. One surface should be polished before heating to reduce to a minimum the work to be done after quenching.

The heating to temperatures from 1,000 deg. 1,200 deg. should be performed in such a way as to avoid superficial oxidation of the metal. A lead bath has been suggested for this purpose.

Duration of heating, 1 minute, 5 minutes, and 1 hour.

Quenching to be effected if possible in a completely liquid bath of calcium chloride solution at —50 deg. C. ; or, in default of this in a brine bath at —20 deg. C., or, in default of this, in water at 0 deg. C. Cooling might be obtained by the aid of liquid carbonic acid. In any case freezing mixtures containing solid fragments of salt or ice must not be employed because

these oppose the free circulation of the liquid and give very irregular results; sometimes the quenching is less thorough than in water at the ordinary temperature.

Polishing is to be done entirely by hand. Emery grindstones and felt discs are not to be used. Polishing should be performed on a wetted surface, e.g., emery papers moistened with Terebenthene oil can be used. With these very rapid work can be done.

Finally, the conditions will be studied under which the destruction of austenite takes place by heating at definite temperatures, and during a definite time period.

It should be understood that all the experiments indicated here may not be necessary. By commencing with steel 0·6 per cent. carbon of two millimetres thickness and quenching at 1,200 deg. C., if no trace of austenite is found, it is useless to proceed further with the same steel.

It would, however, be very interesting if those investigators, within whose power it lies, were to make quenching experiments on small specimens of metal, subjected to industrial cementation, the quenching being performed at the exit of the cementation furnace without any previous cooling. Splendid austenite is thus obtained whose magnitude greatly facilitates its examination.

In order to characterise the austenite two characteristics will be employed—those of chemical attack and of hardness.

CHEMICAL ATTACK.

The two reagents which seem to give the best results are picric and nitric acids dissolved in various alcohols, the concentration, temperature, and duration of attack being specified. It would be very useful to define the most advantageous conditions of attack, but they will probably vary a little with the manganese and silicon contents of the steels. Experiments might be made with the two following reagents, recently described by Mr. Kourbatow as particularly interesting:—

(1.) A 4 per cent. solution of nitric acid in iso-amyl alcohol.

(2.) Concentrated hydrochloric acid .. 5 parts.
Iso-amyl alcohol .. .. 20 ,,
A saturated solution of nitro-aniline or ortho-mononitro-phenol in ethyl alcohol .. 75 ,,
100 parts.

HARDNESS.

The difference between the hardness of austenite and that of martensite, which always accompanies it, will be tested by scratching either by means of very fine points of more or less hard materials and subjected to varying pressures, or by means of powders of different hardness. The excellent results obtained with the specimens prepared at the exit of the cementation furnace are superior to those obtained with laboratory specimens, and this characteristic which is one of the best of austenite, is easily spoilt.

STUDY OF THE CONDITIONS OF PRODUCTION OF THE OTHER CONSTITUENTS OF STEEL.

The same dimension of specimens—

To the three preceding series of steels, two more will be added, with a 0·2 per cent. and 1·8 per cent. carbon. These latter will be useful in defining the conditions of production of troosto-sorbitic structures which are still more obscure than those of austenite.

To the preceding quenching temperatures a complete series between 600 deg. and 800 deg. C. both on heating and cooling is to be added for the study of troostite. Quenching in water at the ordinary temperature should suffice. To the etching reagents previously mentioned will be added the two following particularly recommended by Mr. Kourbatow for the study of troosto-sorbitic compounds.

(1.) Methyl alcohol .. .. .. 25 parts.
Ethyl ,, ... 25 ,,
Amyl ,, ... 25 ,,
A 4 per cent. solution of nitric acid in acetic anhydride .. .. 25 ,,
100 parts.

(2.) A 4 per cent. solution of nitric acid in ethyl alcohol .. .. 25 parts.
A saturated solution of ortho-mononitrophenol in ethyl alcohol 75 ,,
100 parts.

It is probable that in these cases the duration of heating will have to be particularly studied.

The troosto-sorbite, which is obtained in steels with more than 1 per cent. carbon quenched about 1,000 deg. C., is always grouped round the cementite, seeming to indicate that there has not been time for the diffusion of the latter to take place in a uniform manner throughout the whole mass.

It was suggested that these studies should be extended over a period of about six months, and that the results should then be published.

USES OF ELECTRICITY IN MINES.

By HENRY WILLOCK RAVENSHAW, A.M.INST.C.E.

I PURPOSE to describe as far as possible the various applications of electricity in general use in mines and to give some data that have been obtained from actual practice.

A large colliery may have an output of over 2,500 tons a day, representing six or seven of the immense coal trains that we constantly see on our main lines, and in some cases, the whole of this coal is brought up one shaft 500 yards deep in 10 or 12 hours. Taking an average thickness of seam of 4 ft., this represents an area of an acre and a half of coal removed per week, or, say, 75 acres per annum. The result of so large an output is, that the distance from the shaft to the coal face (the place where the coal is actually obtained) becomes greater every year, and in many cases the coal has to be handled a mile underground before it reaches the shaft. To obtain these vast outputs, machinery has to be used wherever possible, and a large amount of power is required both underground and on the surface.

Compressed air is very largely used, and although the losses in the pipes are not so great as where steam is employed, the practical impossibility of warming the air before it reaches the engines prevents a satisfactory economy from being obtained. Electrical transmission presents many advantages for this class of work, as the efficiency of transmission is high, the cables are easily carried down the shaft, and through roadways, and the motors have been brought to such a state of perfection that breakdowns are infrequent. It is, of course, understood that where there is electrical energy there is some chance of a spark being obtained that would ignite inflammable gas. Large numbers of motors are, however, in use in fiery collieries, and where adequate precautions are taken there is little or no danger. This is borne out by the fact that there are hardly any cases on record where a serious fire or an explosion has been traced to the use of electricity.

I propose to take each application of electrical driving separately, and to give in some cases actual load curves that have been taken from the machines themselves. The annexed table shows the various classes of machinery that are in general use, with the type of load and the range of sizes that are usually met with.

WINDING.

Steam engines are at present almost universally used for winding, many of them being of large size, and capable of raising heavy loads at a high speed. The character of the load requires rapid acceleration and retardation with extreme accuracy of control.

Some electrically-driven winding engines of large size have been erected on the Continent, and are giving satisfaction; a good many are also being erected in this country. For small pits and staples (shafts connecting one underground level with another) electrical winding engines have been in use for a good many years, and I know of one which was put down in 1891, and has been in use ever since. Owing to the large amount of power required, and the extreme variations of the demand, the large electrical winding engine presents one of the most difficult problems that the electrical engineer had to deal with.

The problem is that the engine has to start a heavy weight of, say, five tons, from rest, raise it 500 yards in 40 seconds, stop for 15 seconds, and repeat the operation in the reverse direction. This means that the engine must be given enormous starting effort, and develop from 1,500 to 2,000 h.p. for 30 seconds. It must also be capable of absorbing a large proportion

	Usual Sizes.	Type of Load.
Winding	50 to 2,000 B.H.P.	Intermittent with frequent short stops.
Single rope haulage	5 to 200 B.H.P.	Intermittent with long stops.
Continuous haulage	15 to 500 B.H.P.	Steady load.
Main and tail haulage	15 to 100 B.H.P.	Intermittent with fairly long stops
Locomotives	15 to 100 B.H.P.	Intermittent with variable stops.
Creepers	10 to 30 B.H.P.	Continuous variable load.
Coal cutters	20 to 50 B.H.P.	Intermittent with variable stops.
Pumping	5 to 500 B.H.P.	Steady load.
Air compressors	20 to 100 B.H.P.	Intermittent.
Fans	20 to 200 B.H.P.	Steady.
Screens	20 to 50 B.H.P.	Steady load.
Coal washing	20 to 100 B.H.P.	Fairly steady.
Stamps	15 to 100 B.H.P.	Steady.
Crushers	20 to 100 B.H.P.	Very variable.

of the energy that has been put into the load so as to enable an accurate stop to be made at the end of its travel. It must be remembered that the moving parts are of great weight, and move at a high velocity, thereby increasing the difficulties in acceleration and retardation.

Where rapid and economical winding is necessary, it is important that the load should be as uniform as possible, and this requirement is not obtained when the cages are unbalanced.

A number of different methods have been employed for giving a better balance, and a method which has many advantages is the use of a balance rope. This consists of a rope passing round a pulley at the bottom of the shaft, and one end fastened to each cage. By this method the weight of the rope is balanced and the load is constant, namely, the coal to be raised.

By the use of a heavy balance rope the stresses due to inertia can also be partly balanced. This method of balancing is frequently used in this country, and it is doubtful if really fast winding can be economically carried out without this or some similar arrangement.

APPARATUS FOR TAKING CONTINUOUS RECORDS.

I have designed an apparatus for taking continuous records, and have shown on Figs. 1 and 2 the result of tests taken from two large steam winding engines of modern design under actual working conditions. The engines are of very similar size, but in one case the weight of the ropes is balanced, and in the other it is unbalanced.

Fig. 1 shows that with the balanced arrangement a much higher rate of acceleration is obtained, steam being on the pistons for two-thirds of the running time, and the cages are very promptly brought to rest. In the unbalanced arrangement although the maximum horse-power developed per ton of coal raised is greater, the speed of wind is less, the acceleration and retardation are less rapid, and steam is only applied to the pistons for one-half of the running time. It is an interesting fact that in neither case were the brakes used for retarding, and the large amount of energy required to stop should be noted. The peculiar shape of the power curve is due to the fact that in each case when the engine attained a speed of about 40 revolutions per minute an automatic cut-off came

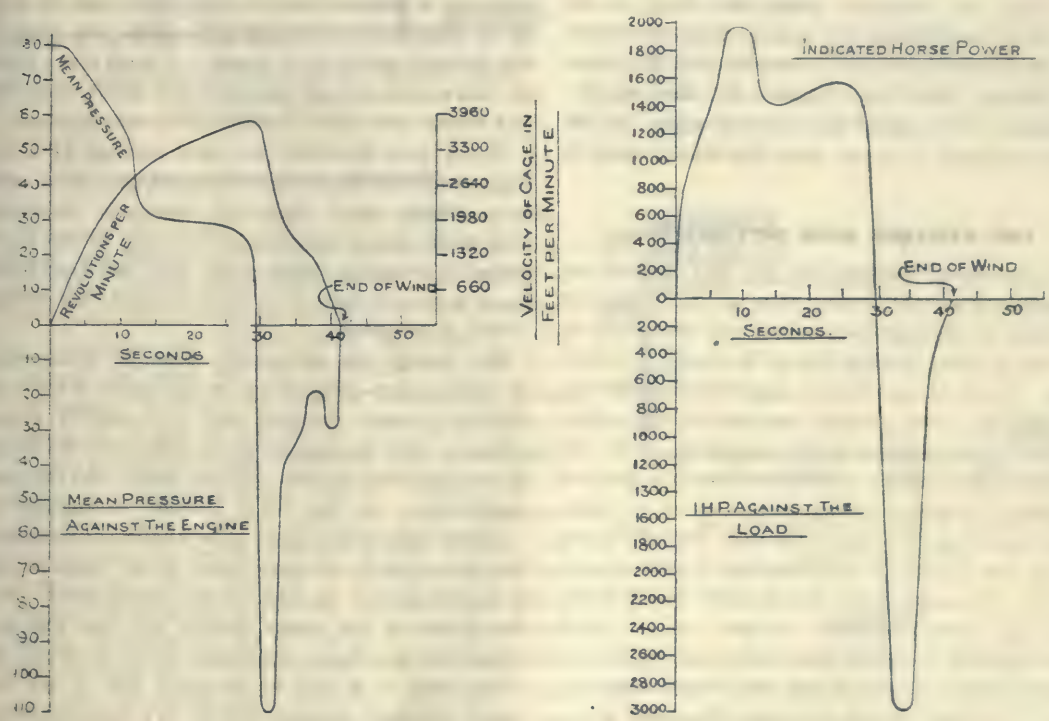


FIG. I. WINDING ENGINE WITH ROPES BALANCED.

Results obtained from time-pressure diagram taken April 7th, 1905; weight of coal raised 4 tons 15 cwt.

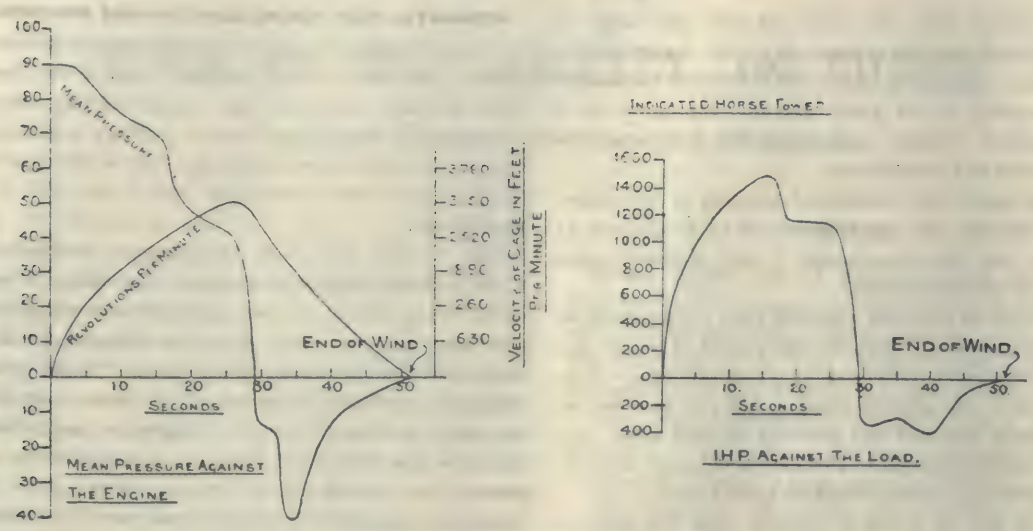


FIG. 2. WINDING ENGINE WITH ROPES UNBALANCED.

Results obtained from time-pressure diagram taken April 7th, 1905; weight of coal raised 3 tons.

into play. To illustrate the tremendous variations of load on the cylinders, I would point out that in fig. 1 steam was admitted during the whole of the stroke for six revolutions, but was cut off at one-fourth of the stroke for fourteen revolutions, and the valves were reversed with steam against the load for five revolutions. The engine was moving again in the opposite direction in 12 sec. from the time it came to rest.

THE VARIABLE LOAD DIFFICULTY.

Although these diagrams do not bear directly on the question of electric driving, they are of the greatest importance as showing the kind of load that must be dealt with if rapid winding has to be carried out electrically. It will be seen that to apply electrical driving to so variable a load presents considerable difficulties, and that if the demand on the supply is to be free from sudden fluctuations, some method must be adopted for storing up energy during the period of no load. Accumulators can, of course, be used, but the heavy first cost and upkeep are unfavourable to their general adoption. For small plants it is probable that a motor having the speed regulated between, say, a third and full speed by means of shunt resistance, would give a simple solution, in conjunction with a motor carrying a heavy flywheel running free and connected across the mains. For large plants a more elaborate system has in some cases been adopted. The most characteristic of these is that adopted by Messrs. Siemens and Halske—the Ilgner system. The flywheel used in this system is very heavy, and running at a high speed, stores up a large amount of energy which can be given off as required by automatically causing the speed of the primary motor to be varied. A good many plants on this system are in successful use on the Continent, and several are under construction in this country.

Heavy steel flywheels are used running at a very high peripheral speed, and the result of a burst wheel or a broken shaft might be extremely disastrous. It is of the utmost importance that they should not be placed in a winding engine room, and that they should be so arranged that, in case of accident, the damage would be localised.

Mr. Georgi has advocated a simple arrangement in which a high-speed steam or gas engine is employed driving a heavy flywheel and a separately excited dynamo. The dynamo would be connected electrically to the separately excited winding motor, and the speed controlled as in the Ward Leonard arrangement.

At first sight this appears to be a useless complication, but given highly efficient steam or gas engines there is a great deal to be said for the arrangement. With the advent of the steam turbine, and the still more economical gas engine producing electrical energy at a cheap rate, it is safe to prophesy that in the near future electrical winding will be very largely adopted.

Underground haulage comes next in importance to winding, as with modern developments of large collieries the coal has very often to be hauled under-

ground for a distance of two or even three miles. In this country most of the coal seams lie on a slope, and consequently, although the coal that is obtained from the higher level will descend by gravity to the bottom of the shaft, the remainder has either to be brought along the level or uphill. Wire rope haulage is almost always employed.

Where the slope is not less than 1 in 20 the empty corves will descend taking the rope with them and either single or double loads are employed. In the case of double rope haulage, the system is very similar to that adopted in winding, and the load is of the same character. With a single rope the motor runs in one direction as, in lowering, the drum is let free, the empty corves unwinding the rope as they run down the incline. The load on the motor is consequently intermittent, the motor not being in use for more than half the time.

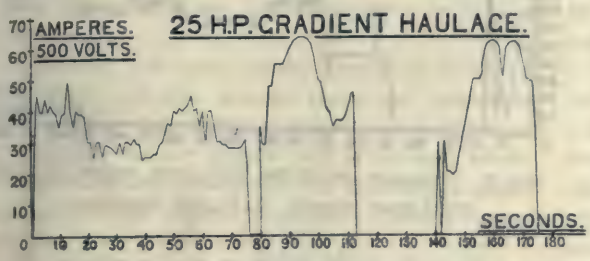


FIG. 3. LOAD CURVE FROM 25 H.P. SINGLE ROPE HAULAGE MOTOR.

SOME CURVES AND RECORDS.

Fig. 3 shows a load curve taken from a 25 h.p. single rope haulage motor, from which it will be seen that there were excessive variations of load owing to curves and steep places on the incline. This demand on the supply was repeated every half-hour.

Where the roads are flat or undulating, main and tail haulage is frequently used, a second rope being carried on pulleys to the end of the roadway, round a large pulley, and back to the tail end of the train. There is therefore a rope attached to each end of the train, and it can be hauled in either direction. In this case the motor does not usually reverse, two drums being fitted connected to the shaft by clutches. The motor generally starts with the load, and owing to the trains having to be hauled in both directions, the demand for current occurs twice as frequently as with the single rope haulage. Continuous rope haulage is very largely adopted and has many advantages. There are two roads, main and return, and the corves are either attached to the rope singly or in sets, the speed being about four miles per hour. The advantages of this system are regular supply slow speed, and consequently, fewer accidents.

The load on the motor is an excellent one. Fig. 4 shows a record taken from a 25 h.p. single rope haulage plant, which is only intermittently used, there being twenty runs of about five minutes' duration in eight hours. Where several roads are served, and separate ropes used for each road, all the rope pulleys are driven from one motor, and the demand is remarkably steady. I have frequently seen the ammeter connected to a 200 h.p. motor remain steady to within 5 per cent. for long periods. Some very large continuous haulage motors are at work in this country.

Electric locomotives are very little used in this country, the only one with which I am acquainted being in the Greenside mines, under Helvellyn, in Westmoreland. In the United States they are largely used, the coal being more free from faults than in this country, and the roads consequently more level. In many of their collieries the coal outcrops and the locomotives are able to bring trains out of the hillside without the intervention of a winding shaft. Electric locomotives are capable of working up an incline of 1 in 20. A trolley wire or live rail cannot of course be used in fiery mines.

The creeper form of conveyor is frequently used at pit bottoms and on the surface. The load is somewhat intermittent, but the power required is small. Electrical transmission is extremely convenient for these small applications.

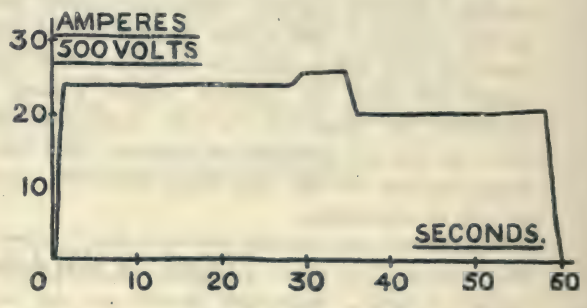


FIG. 4. RECORD TAKEN FROM A 25 H.P. SINGLE ROPE HAULAGE PLANT.

PUMPING.

This is a most important application. In some cases the weight of water raised exceeds the output of coal. The extreme flexibility of electrical transmission makes it particularly useful in the case of shaft sinking, and for following drifts and workings that are on a downward slope. In many cases very little power

is required, as a very small pump will deal with 20 gallons a minute, but unless dealt with, that flow of water will very soon flood out a large district. In one of the collieries with which I am connected, two pumps, absorbing together not more than 10 h.p., have entirely cleared a flooded district, the water-level being reduced by 150 ft. The ordinary three-throw pump is a most useful type, and is very largely used. Dip pumps are mounted on a truck, and are moved down the falling roadway as the water is pumped out. Some very large pumps are in use on the Continent coupled direct to slow-speed motors.

Electrical driving is particularly applicable to centrifugal pumps, and it is on record that a pump of this kind is working against a head of 1,850 ft. and raising 1,750 gallons per minute. A pump load is an extremely good one from the supply point of view, as the demand is practically steady. Electrical pumps are frequently placed in out of the way places, and receive attention perhaps twice a day. A very convenient and economical arrangement can be obtained where the generating station supplies current for haulage during the day and for pumping at night. The capital expenditure is kept down in this way to a minimum.

COAL CUTTING.

This is an extremely important application of power to mining, and a large number of electrically driven machines are at work. They can be divided into three classes, namely, disc, chain, and bar cutters. Special merits are claimed by the makers for each type of machine, the disc machine being most largely used in this country. The system of getting the coal known as long wall is generally employed where coal cutters are used, the machine usually making a horizontal cut from 4 ft. to 6 ft. underneath the coal. As the cut proceeds the machine hauls itself along the face of the coal, being supported either on rails or on a sledge.

Series motors are generally used with direct currents. The Diamond Coal Cutter Company use two motors coupled in series. Multiphase motors are also successfully used for this work, but the great starting effort that a series motor will develop makes the continuous current machines more popular with the men, especially where deep holing can be carried out. The current is conveyed to coal cutter motors by means of long trailing cables well protected from injury, and arranged so that they can be readily disconnected.

The main cables are generally brought to switch boxes in the gateways at several points along the face, so that a long face can be worked without using cables of excessive length.

Electrically-driven air compressors are being extensively used, and where rock drills are employed advantage is taken of the cheapness and flexibility of electrical transmission to drive the air compressors underground. Compressed air can be more safely used than electricity for coal cutting in very fiery mines, and electrically-driven air compressors fixed some distance in-bye are also being used. There is good reason to believe that this combination of two methods of transmission is likely to be largely employed. There are numbers of other applications of electrical driving in mines, and it is interesting to note that a considerable discussion has been lately going on among engineers in the Rand as to the relative advantages of driving large numbers of stamps by one motor or dividing them into sections. It is likely that the latter system will survive, as the experience of engineers points directly to the great advantages to be obtained in subdividing the plant into sections of a reasonable size.

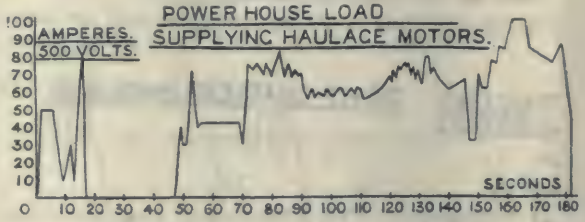


FIG. 5. DIAGRAM SHOWING READINGS FROM DYNAMO SUPPLYING THREE HAULAGE ENGINES.

GENERATING STATIONS.

As I have already pointed out, the load on many classes of mining machinery is of a very variable character, and as a result, the demand on the generating stations is not always a satisfactory one.

In some cases where the haulage is continuous, and there is a good deal of pumping, a steady load is maintained for long periods; but to show that this is not always the case I submit a diagram (fig. 5) showing readings which were taken for three minutes from a dynamo supplying three haulage engines varying in size from 7½ to 25 h.p. It will be seen that at times there was no demand whatever. A dynamo running alongside and supplying screens and washing plant had a practically constant load of 90 amperes.

I should like to point out how important it is for effective governors to be used on the engine. I have known a case where the governors failed on a large

proportion of the load being thrown off, the pressure rose from 500 to 1,200 volts, and a great deal of damage was done. Reliability, good running, and a minimum cost in repairs and attendance are always required in a mine, but extreme economy in steam consumption is not often attempted.

The steam pressures available are seldom more than 100 lb. per square inch at the older collieries, and there is often a remarkable disregard for the fact that every ton of coal burnt, costs quite a large percentage of its actual selling value in labour, boiler repairs, and depreciation.

In spite of the above facts, in many cases a remarkably low cost per unit generated is frequently obtained when there is a steady load extending over long hours. Capital costs, and consequently interest and depreciation, are kept down to a minimum. Attendance costs very little; for instance, an engine giving a steady output of perhaps 100 kilowatts for twelve hours a day, may be looked after by the fan engineman.

In some of the more modern plants the output is quite large, and high pressure steam and condensing are available. Gas engines supplied by coke oven gas will probably be very largely used in the near future, the reliability and economy of the modern gas engine placing it quite in the front rank among prime movers.

CABLES AND DISTRIBUTION.

Owing to the fact that comparatively large powers are required at a considerable distance from the source of supply, and that in fiery mines a pressure of more than 500 volts is not available, the conductors have to be of ample section, and, in many cases, in order to avoid an excessive drop of pressure, the density does not exceed 300 to 400 amperes per square inch.

In the shaft it is necessary to support the weight of the cables, and this is usually done by fixing them in a tight-fitting casing, or by cramping them between stout wooden cleats which are securely fastened to the walls of the shaft. Armoured cables are generally preferred for shaft work, the armouring helping to support the weight of the cable, and taking the stress off the insulation and the conductors.

In the mine the cables have to be carried in various ways, according to circumstances, but the most usual method is to hang them by means of cleats or leather thongs from the timbering. Armoured cables hung in this manner are remarkably free from serious injury, but where there is a danger of damage owing to trains running away on the inclines, or to falls of roof, they have either to be buried in the floor or specially protected.

The shaft cables are generally brought to a distributing point at the pit bottom, from which the cables to the various districts radiate. It is the best practice to build this distributing room of brick entirely fireproof, switchboards, or pillars similar to those used for tramway work, being arranged so that the cables can be conveniently coupled up. Where possible the engine planes, where trains are continually passing, should be avoided, the cables being carried along the travelling roads that are used by men. Branches are made in suitable jointing boxes or in brickwork distributing rooms, similar in a smaller scale to that at the pit bottom. For coal cutters and portable motors, such as dip pumps, the cables are brought to a fixed switch box, and flexible cables carried on to the motors. The efficient earthing of all armouring and of the cases of switches and motors is an extremely important matter, and I am glad to say that this is required by the Home Office to be efficiently maintained. In my own practice, I always employ separate cramps and conductors to make efficient contact between the outer coverings where junction boxes are fitted.

Cantor Lecture before the Society of Arts.

THE NEW TRADE MARKS ACT.

A communication of exceptional interest, signed Reginald W. Barber, 56, Ludgate Hill, E.C., calls attention to the Trade-Marks Act which was passed last session and comes into operation on April 1st, 1906. This, says the writer, will mark a new and most useful era in commercial legislation. One of the first points which arrest attention is the sensible definition of a trade-mark: "It shall mean a mark used or proposed to be used upon or in connection with goods for the purpose of indicating that they are the goods of the proprietor of such trade-mark by virtue of manufacture, selection, certification, dealing with, or offering for sale." Hitherto trade-marks have been held exclusively by manufacturers and

merchants. Now the buyer whos elects, and the expert who certifies the goods, may each register his brand. The Comptroller-General of Patents, Designs, and Trade-Marks is appointed the Registrar of trade-marks, and in any proceedings before him has power, with the consent of the parties to require the attendance of witnesses, take evidence on oath, award costs, and be in the same position in all respects as an official referee of the Supreme Court.

A fruitful source of litigation, pointed out by the same writer, is the vexed question—What is a registrable trade-mark? Section 9 enlarges the scope of registration as follows: "A registrable trade-mark must contain or consist of at least one of the following essential parculars: '(1) The name of a company, individual, or firm represented in a special or particular manner; (2) the signature of the applicant for registration or some predecessor in his business; (3) an invented word or invented words; (4) a word or words having no direct reference to the character or quality of the goods, and not being according to its ordinary signification a geographical name or surname; (5) any other distinctive mark, but a name, signature, or word or words other than such as fall within the descriptions in the above paragraphs (1), (2), (3), and (4) shall not, except by order of the Board of Trade or the Court be deemed a distinctive mark:

Provided always that any special or distinctive word or words, letter, numeral, or combination of letters or numerals used as a trade-mark by the applicant or his predecessors in business before August 13th, 1875, which has continued to be used (either in its original form or with additions or alterations not substantially affecting the identity of the same) down to the date of the application for registration, shall be registrable as a trade-mark under this Act. For the purposes of this section 'distinctive' shall mean adapted to distinguish the goods of the proprietor of the trade-mark from those of other persons. In determining whether a trade-mark is so adapted, the tribunal may, in the case of a trade-mark in actual use, take into consideration the extent to which such user has rendered such trade-mark in fact distinctive for the goods with respect to which it is registered or proposed to be registered."

A company will now for the first time be allowed to register its name if represented in a special or particular manner. This is an improvement on "particular and distinctive" manner" in the present Act. The registration of the signature of the applicant's predecessor is also a useful innovation, as it enables a joint-stock company to register its founder's signature as a new mark. Words having indirect reference to the character or quality of the goods will now be registered. Geographical names and surnames also, which have been excluded under the present law, will now be registrable, if their ordinary signification is not a geographical name or a surname. Any other distinctive mark can be registered. This is very broad, as, under Section 3, a mark includes a device, brand, heading, label, ticket, name, signature, word, letter, numeral or any combination thereof. The registration of associated trade-marks is another important and useful provision. It enables an applicant to register the essential features of a label as separate trade-marks, and the user of the whole label shall be deemed to be a user of such separate trade-marks. A new feature is contained in Section 41, which enacts that registration shall after seven years be taken to be valid in all respects, unless obtained by fraud or calculated to deceive, or contrary to law or morality. It is pointed out by the writer in conclusion that no proceedings to prevent infringement or recover damages in respect of an unregistered trade-mark can be instituted unless the mark was in use before August 13th, 1875, and has been refused registration under the new Act.

THE SOUTHERN RHODESIAN GOLD MINING INDUSTRY.

BY C. E. PARSONS, M.I.M.M.

THE conditions existing to-day in Southern Rhodesia are widely different to those of a few years ago; the general welfare of the community being more dependent upon the existence and prosperity of small individuals than it has been in the past. The growth of tributors and small local syndicates operating mines of their own or properties originally developed and leased to them is one of the most noticeable features.

The value of the gold for the year ending March 31st, 1905, was £1,120,528 or 31·8 per cent. The return for June, 1905, was valued at £127,812, which constitutes a record. This amount was contributed by 72 producers of which about 56 were individuals and local syndicates who have embarked their own capital and labour in the various enterprises.

Of the total value of gold produced for the month of June over £38,000 or 30 per cent. emanated from small owners—from this it will be seen what an important factor they represent. In June, 774 stamps or their equivalent were operating and at the present moment over 200 further stamps or their equivalent are under order.

A large number of properties which have not yet reached the milling stage should be producing in the near future. Of these the following may be mentioned: The Eldorado, Sabiwa, Giant, Jumbo, Battlefields, Cliftor, Yankee Doodle and Etna—all these mines have considerable ore reserves. Milling has just commenced on the Qaika and Beatrice mines, neither of which figure in the June output; in two other cases milling plants are being increased. Allowing for the exhaustion of several of the existing properties a progressive output should still be maintained.

Rhodesia has advantages over the Transvaal in that it is better timbered and watered; against that railway rates are high and materials in consequence more expensive. It has cost the inhabitants £9 10s. to £16 a ton for goods imported by them. Railway rates, however, are shortly to be reduced about 25 per cent. The configuration of the country in a few instances, together with water power, is in its favour; this applies principally to the Umtali district. The ore deposits do not possess the exceptional permanency and stability that obtain in the Rand conglomerate series, but compare favourably with those on most of the other goldfields scattered over the globe both from a geological and mineralogical standpoint.

It is not too much to say that Rhodesia offers a very wide field for small mining propositions, at the same time, low-grade reefs and bodies of ore exist that cannot be well handled by individuals owing to the heavy outlays demanded. Most of the gold is derived from quartz veins and reefs, but a large percentage is also extracted from diorite, schist, and a small amount from alluvial deposits.

In the Lomagundi district a deposit of auriferous conglomerate on the Eldorado mine is attracting a great deal of attention, and excellent results are being obtained. Small owners may now work to a profit under arrangement with the Chartered Company; should they make more than £100 profit a month a royalty of 2½ per cent. is payable on the gold won; if, therefore, profits do not reach £100 no royalty is demanded.

The auriferous area is extensive, large and small gold mines are scattered throughout the territory and exist at wide intervals apart, often many miles from a railway. Mines treating varying tonnages, from 14,000 tons to a few tons of specimen stone or even less are the order of the day.

Working costs are difficult to get at, conditions vary to such an extent that we find every case stands by itself. The president of the Chamber of Mines in his last annual report selects seven representative mines; two large low-grade mines working under exceptional conditions are not included. The following are his approximate figures:—

	£	s.	d.
Mining		10	2
Milling		4	10
Hauling, crushing, sorting and headgear ..		2	9
General		3	0
Cyaniding		3	2
	1	3	11

This does not include redemption, depreciation, etc.; with these additions the amount would work out to about 30s.

Tributors working on a smaller scale, having fewer expenses and not including their own time, would probably work for from 12s. to 20s. a ton. This figure can only be estimated from experience. Altogether about 1,200 whites and 1,500 natives are employed in the mining industry.

Apart from gold, silver valued at £902 and lead at £548 was obtained in June, 1905, while deposits of copper, zinc, and wolfram occur. From the Wankie Collieries, about 7,000 tons of coal is being supplied to the railways, mines, and in other directions. Near Gwelo a waterworn deposit of diamondiferous gravel is being prospected and stones of good quality have been found.

Unlike many Australian "fields," the country under irrigation or during the wet season is capable of producing all kinds of crops, while vegetables grow well. It is an excellent stock-raising country. About 1,100 whites live by farming scattered over 950 farms. These factors will assist the gold industry. The total population consists of 12,000 white people and 565,000 natives living in the country.

In most cases outcrops and the upper portions of reefs of any value have already been removed from the surface to 30 and over 100 ft. by the "ancients," consequently modern mining often commences below the first level.

The general practice in Rhodesia is that adopted in other parts of the world with modifications. The stamp battery (heavy type) finds most favour. A large number of other mills are used by themselves and as auxiliaries. One large dry crushing roller mill is treating upwards of 14,000 tons a month, and another smaller plant is being erected. Over twenty Tremain steam stamps are operating; also ten Huntingdon mills. About five tube mills will shortly be at work.

NEWS ITEMS.

Important Decision.

In the City of London Court on Thursday, Judge Lumley Smith gave a decision under the Workmen's Compensation Act on a point which had not been raised before. A claim was made by Augustus Davis, engineer's fitter, of Hackney, against the Aerated Bread Company, Ltd., for compensation for personal injuries, which had prevented him from doing any work since April 27th. He strained his back while taking to pieces a revolving ventilating fan in the smoke room of the defendant's shop at Ludgate-hill, for the purpose of sending the pieces to the company's repairing factory at Golden-lane. The contention of the applicant was that he was injured while at work "in, on, or about engineering works," within the words of the Workmen's Compensation Act. That was disputed by the defendant company. The Court of Appeal had decided, said Judge Lumley Smith, that engineering works did not mean labour bestowed on such work, but the locality where such labour was bestowed. The process of repairing a fan did not become engineering work till the pieces reached Golden-lane, when machinery would be used upon them. The work done at Ludgate-hill was not, therefore, engineering work, though preliminary and essential to the subsequent engineering work. He was obliged, therefore, (though with regret, for he thought it an honest case), to decide against the applicant. Judgment was given for the defendants, with costs.

Commercial Intelligence Committee.

At the Bradford Chamber of Commerce last week the president, Mr. W. H. Mitchell, announced his appointment on the new advisory committee on commercial intelligence in connection with the Board of Trade. The other members are Sir Forbes Adam, of Manchester, Lord Avebury, Sir Alfred Bateman, Sir Hugh Bell, Mr. H. Birchenough, Mr. T. F. Blackwell, Mr. F. Brittain, of Sheffield, Mr. T. Craig Brown, Mr. A. Wilson Fox, of the Board of Trade, Mr. C. A. Harris, of the Colonial Office, Mr. T W. Holderness, India Office, Sir William Holland, M.P., Sir Francis Hopwood, Board of Trade, Mr. A. Bonar Law, M.P., Board of Trade, Mr. Algernon Law, Foreign Office, Mr. R. L. Paterson, Sir Albert Rollit, M.P., Mr. H. Llewellyn Smith, Board of Trade, Lord Strathcona, and Mr. D. A. Thomas, M.P., with three others, not yet appointed, who are to represent South Africa, Australia, and New Zealand.

The Westinghouse Brake Company, Ltd., advise us that they have secured the exclusive rights, under the Morse-chain patents, to manufacture and sell the Morse Rocker joint silent high-speed chains in Great Britain and on the Continent of Europe. They have just completed a new building at York-road, King's Cross, N., fully equipped for the manufacture of these chains.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Upton Scudamore. — Carrying out a waterworks scheme for the village of Upton Scudamore, for the Warminster Rural District Council. Mr. A. F. Long, 53, Market Place, Warminster ... ... Sept. 9

Hull.—Construction and erection of the new steel swing-bridge over the River Hull at Sculcoates, on their Victoria Dock branch, and weighing about 450 tons, for the North-Eastern Railway Company. The contract will include the removal of the existing swingbridge, the raising of the public road, and the building of river walls, timber jetty, etc. Mr. W. J. Cudworth, company's engineer, York ... ... Sept. 11

Bristol.—Construction, delivery, erecting in place, testing, and maintenance for 12 months of pumping machinery for the dry dock now in course of construction at Avonmouth, in the port of Bristol, for the Docks Committee. The contract includes steam engines, centrifugal pumps, steam-boilers, and all auxiliary machinery and piping for the complete installation. Mr. W. W. Squire, Cumberland Road, Bristol. Sept. 11

London.—Supply and delivery of 150 wagons and 10 brake vans, for the Directors of H.H. the Nizam's Guaranteed State Railways Company, as per specification to be obtained at the Company's offices for 10s., which amount will not be returned. Mr. H. Rendel, Winchester House, 50, Old Broad Street ... ... Sept. 11

Sculcoates.—Construction and erection of the new steel swing-bridge over the River Hull at Sculcoates, on their Victoria Dock branch, and weighing about 450 tons, for the North-Eastern Railway Company, including removal of existing swingbridge, the raising of the public road, and the building of river walls, timber jetty, etc. Mr. W. J. Cudworth, the company's engineer, York ... ... Sept. 11

Bishop's Stortford. — Supplying and fixing gas pumping engine, suction gas plant, and sewage pumps at sewage pumping station. Mr. Thos. Swatheridge, clerk, Council offices, 7, North Street, Bishop's Stortford ... ... Sept. 12

Knottingley.—Supply of a cast-iron settling tank (capacity 80,000 gallons), steel girders, brick piers, etc. Messrs. Garside and Pennington, Pontefract ... ... Sept. 12

Last Day.

Ipswich.—Supply and erection of a dynamo and motor, a battery booster, and alterations and additions to the main switchboard at the workhouse. Mr. Richard J. Kent, clerk, 19, Tower Street, Ipswich ... ... Sept. 14

Stockport.—For the supply and laying of electric lighting cables, for the Gas and Electricity Committee. Specifications, conditions, and form of tender may be obtained on application to Mr. A. J. H. Carter, borough electrical engineer, Millgate, Stockport ... ... Sept. 14

Linlithgow.—Supply and erection of the undernoted plant and material for the extension of their present electric lighting, for the Uphall and Broxburn District Lighting Committee; one suction gas-producer plant of 80 b.h.p. capacity; one 80 b.h.p. gas-engine; one 52 k.w. dynamo; one automatically-reversing motor booster, two 280 ampere-hour storage batteries, switchboard, cables, meters, etc. Consulting engineer, Mr. A. Lindsay, 11, Jamaica Street, Glasgow ... ... Sept. 18

Portsmouth. — Provision of machinery, forges, engines, lathes, etc., required in connection with the fitting up of the new manual instruction centres for the Portsmouth Education Committee. Mr. Alfred H. Bone, Cambridge Junction, Portsmouth ... ... Sept. 18

Colwyn Bay.—Construction of water-supply works required for the higher parts of the district known as Upper Colwyn Bay, for the Colwyn Bay and Colwyn Urban District Council. The works comprise the construction of a concrete service reservoir, the erection of pumping station and machinery, and the laying and jointing of all the necessary pumping and supply mains. Mr. W. Jones, water engineer and surveyor, Colwyn Bay, N.W. ... Sept 19

Immingham. — Construction of a new dock, having a water area of about 42 acres, together with a lock and entrance from the river Humber, entrance jetties, river embankments, drain diversion, and other contingent works; also a double line of railway, about 4½ miles in length, and other railways and sidings surrounding the dock, having an aggregate length of about 4 miles. Sir John Wolfe Barry and Partners, 21, Delahay Street, Westminster ... ... Sept. 20

Bamford (near Sheffield).—Contract A. Construction of the Bamford filters and the Ashopton to Grindleford section of the Derwent Aqueduct, in the county of Derby, for the Derwent Valley Water Board. Mr. E. Savdewan, engineer to the board, Bamford ... ... Sept. 25

COMING CONTRACTS.

Preston.—The District Council have received sanction to a loan of £4,000 for waterworks.

Hereford.—An inquiry has been held into the application of the Town Council for sanction to borrow £2,343 for the purposes of water supply for the city.

Craster (Northumberland).—The construction of the proposed new harbour is expected to be commenced during the autumn of this year. The engineers (Messrs. Sandeman and Moncrieff) are asking for tenders.

Hanley.—In consequence of the subsidence of the Cauldon-place canal bridge, the North Staffordshire Railway Company consider it to be absolutely necessary to raise the bridge and to construct a new lock at a cost of £8,000.

Brighton.—The Corporation has agreed to the recommendation to spend £38,500 on electrical plant extension.

Scunthorpe.—At a special meeting of the Urban District Council plans and specifications for an electric supply undertaking were approved, and it was decided to apply for sanction to borrow £4,500 to carry out the works.

CONTRACTS CLOSED.

Plymouth.—The old Cork Quay at the Great Western Docks, Millbay, Plymouth, is about to be extended a further 100 ft., with a width of 64 ft. The contract for carrying out the work for the Great Western Railway Company has been secured by Mr. E. B. Lester, of Plymouth.

Glasgow.—The contract for the diversion of Pointhouse Road so as to admit of the construction of basins and quayage at Yorkhill has been let to Messrs. A. and J. Faill, Glasgow.

Nile-Khargeh Railway.—The contract for the supply of rails and permanent way material for the construction of the Nile-Khargeh Railway has been placed with Messrs. Dick, Kerr and Co.

Malaga.—Messrs. Mather and Platt have secured the contract in connection with the reserve steam station of 2,000 b.h.p. The contract, obtained in face of severe competition, includes boilers, steam turbo-alternators, rotary convertor, switchboards, and piping. This installation will be one of the first steam turbine stations in Spain.

London.—Messrs. Hadfield have received two large contracts from the London County Council for special points and crossings in connection with its extensive tramways undertakings.

Warrington.—The County Borough has accepted the tender of Messrs. Johnson and Phillips for 12 months' supply of paper insulated lead-covered cables.

Neath.—The Rural District Council has accepted the tender of Messrs. Johnson and Phillips, Old Charlton, Kent, for cables and street lighting for the districts of Skewen, Melincrythan, Cadoxton, and Aberdulais.

Admiralty.—The Admiralty have given out the orders for the heavy armour plates for the battleships now building. These are divided between Messrs. William Beardmore and Company, Ltd., Messrs. John Brown and Company, Ltd., Messrs. Vickers, Sons, and Maxim, Ltd., Messrs. Cammell Laird and Company, and the Armstrong-Whitworth Company. The armour contracts for the cruisers building have yet to be placed.

Aberdeen.—The contract for manganese steel points and crossings and special track work, for the Aberdeen Harbour Commissioners has been awarded to Hadfield's Steel Foundry Company, for permanent-way materials :—(1) Steel rails and guard rails; (2) steel fishplates; (3) steel fishbolts and rail clips; to Steel, Peech, and Tozer, Sheffield; and T. Summerson and Sons, Darlington.

APPOINTMENTS VACANT.

Leigh.—Chief assistant to Borough engineer. Salary £130 per annum. Mr. Stanley Wilson, town clerk ... ... Sept. 11

Todmorden.—Gas engineer. Todmorden Corporation. £200. Town clerk ... ... Sept. 16

King's Lynn.—Borough surveyor and waterworks engineer. King's Lynn Corporation. £250. Mr. J. W. Woolstencroft, town clerk ... ... Sept. 18

Poplar.—Junior demonstrator in physics and electrical engineering to the London County Council School of Marine Engineering, Poplar. Salary at the rate of 10s. 6d. an evening ... ... Sept. 11

Bristol.—Assistant lecturer and demonstrator in engineering is required at the Merchant Venturers' Technical College, Bristol. £170. Registrar ... ... Sept. 18

Handsworth, Staffs.—Station Superintendent and an assistant engineer for the Council's electricity works. £120 and £100 per annum respectively ... ... Sept. 30

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—
Consols : Oct. 4th. General Settlements : September 14th, 28th, October 13th. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅛ — 2⅜
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4½ — 5
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3⅜ — 3½
76,970	5	2/-	Do. 4% Cum. Pref..	5	5⅜ — 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102½ — 104½
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	2/4½	Babcock and Wilcox, Ltd., Ord. ..	1	8⅝ — 8¾
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1 5/16 — 1 7/16
20,000	5	3/-.	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4⅜ — 5½
250,000	1	6¾d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —104
150,000	4½	2/8½	Barrow Hæmatite Steel Co., Ld., O.	4½	1 3/16 — 1 5/16
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛ — 4⅜
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4⅜ — 5½
£500,000	100	4½%	Beardmore (Wm.) & Co., Ltd. 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104½—106½
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ — 12½
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	100—102
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	15/16 — 1
300,000	1	6¾d.	Do. 5½% Cum Pref.	1	13/16 — 15/16
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	93 —96
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	31/32 — 1 1/32
1,860,900	1	3⅜d.	Do. Nos. 1,639,101-3,500,000	12/-	31/32 — 1
1,160,000	1	10½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1½ — 1¾
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1 1/32 — 1 1/16
74,000	10	5/-	Do. 5% Cum. Pref.	10	11⅛ —11⅜
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord. ..	5	9¼ — 9⅜
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5 3/16 — 5 5/16
450,000	1	1/2⅜	Clayton & Shuttleworth, Ltd., Ord.	1	15/16 — 1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5¼ — 5½
£250,000	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	100 -102
100,000	10	30/-	Consett Iron Co., Ltd., Ord.. ..	7½	32½ — 33½
57 031	10	10/-	Crossley, Bros., Ld , Ord. 40340/97370	10	15⅝—15⅞
40,339	10	5%	Do. 5% Cum. Pref.	10	11½—11⅝
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 — 2¼
1,259,594	1	3⅜d.	Dorman, Long & Co., Ltd..	1	7/16 — 1/2
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	90 —94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	3¼ — 3⅜
250,000	1	9⅜d.	Dunlop (James) & Co., Ltd., Ord...	1	1 — 1⅛
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	15/16 — 1
4,721	13	13/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½ — 9½
69,754	13	10/-	Do. do. do.	10	6⅞—7¼
20,250	10	8/-	Elliott's Metal, Ltd.	8	5⅜ — 5⅝
5,000	10	5%	Do. Cum. Pref. 5%	10	8⅞ — 9¼
186,748	Stk	4%	Do. Deb. 4%	100	90 — 94
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	11 —11½
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000..	10⅛	12½—12½
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10⅛
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	3⅞—4¼
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5½ — 6
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6½— 7½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	88½—89½
16,800	10	10/-	Greenwood & Batley, Ltd., Ord. ..	10	6½— 7½
9,600	10	7%	Do. 7% Cum. Pref.	10	10 — 10½
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅜ — 2½*
344,000	5	2/6	Do. 5% Cum. Pref.	5	6⅜ — 6⅝*
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 —107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2 — 3
250,000	1	1/-	Hadfield's Steel Fdry Co., Ld., Ord.	1	3⅜ — 3¼*
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ — 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5⅞ — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	3/4 — 7/8
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	97— 99
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5 — 5½
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	11/16—13/16*
18,000	5	3/-	Do. 6% Cum. Pref.	5	4½ — 5*
£100 000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	98—100

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
750,000	1	7½%	Howard & Bullough, Ltd., Ord. ..	1	1 7/8 — 1 15/16
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12½ —13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1906	100	95 — 98
37,500	10	20	Kynoch, Ltd.	10	17 —17½
49,537	10	5%	Do. Cum. Pref. 5%	10	10½ —10⅝
300,000	1	4½d.	Lambert Bros., Ltd., Ord.	1	3/4 — 7/8
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 —4½
40,000	3	2/1½	Leeds Forge Co , 7% Cum. Pref. ..	3	3⅞ 4
200,000	1	7½d	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16 — 1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 — 10
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11½—11¾*
210,000	1	8⅝d.	Measures Bros., Ltd., Ord.	1	1/2 —1⅜
75,000	1	6¾d.	Do. 5½% Cum. Pref.	1	3/4 — 7/8
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	93 — 96
21,943	5	2/6	Muntz Metal, Ltd.	5	4½ — 5
14,248	5	5%	Do. Pref. 5%	5	4⅝ — 5½
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	79 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅛—12⅜
80,000	5	—	North-Eastern Steel Co., Ltd., 4½% 1st Mrt. Db. Stk., Red.	100	88 — 91
£250,000	Stk	4½%			
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	4½— 4⅝
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	6¼— 6½
70,000	10	10/-	Pease & Partners, Ltd., Ord. ..	10	9⅜—10¼
£100,000	Stk	4%	Do. 4% Perp. Deb. Stock .	100	100—102
20,000	5	3/-	Peebles(Bruce) & Co.,Ld., 6% Cm.P.	5	4½— 5⅜
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	6/- — 6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	4½— 4¾
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	3/4 — 7/8
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅝ — 1¾
73,062	5	2/-	Do. New	5	1¼— 1⅜
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	99—101
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	13/16 — 7/8
£350,000	1	7½	Do. 6% Cum. Pref.	1	1 1/16 — 1 1/8
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	94 — 97
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	10 —10½
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	— 3/4
300,000	1	7½d.	Do. 6% Cum. Pref.	1	7/8 — 1*
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	93 — 95
£115,800	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	93 — 96
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	95 — 99
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	3/4 — 7/8
300,000	1	1/2⅜	Do. 6% Cum. Pref...	1	13/16 — 15/16
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	92 — 95
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	6¾ — 6¾
£125,240	Stk	5%	Do. 5% Trust Mort. Deb. ..	100	105—106
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	1½ — 2½
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	3½ — 4½
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	80— 85
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17⅜—18½
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½ — 14¾
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	3/4 — 7/8
538,845	1	6d.	Do. 5% Cum. Pref.	1	15/16—1 1/16*
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	96 — 99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	3/4 — 7/8
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	80 — 83
£148,500	1	7½d.	Thornycroft (John I.) & Co., Ltd. Or.	1	3/4 — 7/8
£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	15/16 — 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½ — 9¾
$508495200	$100	$3½	United States Steel Corp. Com. Stk.	$100	37¼ — 37⅜
$360314100	$100	$1½	Do. 7% Cum. Pref. Stock	$100	106¼—107
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	100—102
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord..	1	2⅜ —2⅛
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1 1/16 — 1 1/8
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	120 —123
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	104 —106
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 —108
225,000	1	1/2⅜	Weardale Steel, Coal & Coke, Ltd., Def. Ord,	1	13/16 — 15/16
500,000	1	7½d.	Do. 6% Cum. Pref. Ord. ..	1	7/8 — 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	86 — 88
7,687	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4½ — 4⅞
500	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/-	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2⅛ — 3⅛
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	73 — 78
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	74 —76

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	1/9⅜	London Elec. Supply Corp., Ld., Ord.	3	2 —2¼
60,000	5	3/-	Do. 6% Pref.	5	4⅞— 5⅛*
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 -102
100,000	10	5/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	10½—10⅝
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅜— 5⅝
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —113
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	99 —101
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	100—102⅝
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14 — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6½— 7
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£94,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13½—14½
20,000	5	3/6	Do. 7% Pref...	5	8½— 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	97 —99
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2½ — 2¾
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	76 — 80
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3½ — 4
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	13/16 -15/16
50,000	1	8⅝d.	Do. 7% Cum. Pref.	1	1¼ — 1⅜*
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	106 —109
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4¼ — 4⅞
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅜— 5⅝
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	105—107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12⅜ -13½
28,151	5	2/6	Do. 5% Cum. Pref.	5	6⅛ —6⅝

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
£35,000	10	—	Amazon Telegraph Co., Ld... ..	10	3 — 5⅛
£763,580	Stk	14/-	Anglo-American Tel. Co. Ltd., Ord.	100	59 — 61
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	105⅛—106½
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	15⅛— 15½
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7⅜— 7⅝
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	—
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96½—98½
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8⅞— 9⅛
6,000	10	10/-	Do. 10% Preference	10	17½—18½
6,000	5	2/- 5/-	Direct Spanish Telegraph Co., Ord. 10% Cum. Preference	5 5	3⅜— 3⅝ 9¼— 9⅝
£30,000	50	4½%	Do. 4½% Debs...	50	100-103⅝
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	11⅜—12
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Debs.	100	99½—101¼
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101½103¼%
200,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13⅜—14½
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 —108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	144 —147
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	90½—92½
£1,886,814	Stk	4%	Do. 4% Mort. Deb.	100	108 —110
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	35 —36
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	52½— 54½
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	⅜— ⅝
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	110½—111½
£1,966 667	Stk	5%	Do. Deferred	100	107½—109½
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅜ — 5⅞
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	99½—101⅜
£689,593	Stk	4%	Do. 4% do. do. ..	100	104 -106
179,313	1	8¾d.	Oriental Telephone & Elec. Co., Ltd.	1	1 3/16—1 5/16
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 3/16—1 5/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	100—103
11,889	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7⅞ — 8¼
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7⅜
40,000	5	2/6	Do. 5% Cum. Pref.	5	5¼ — 5½
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	109½—111½
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	10—10½
£30,008	2½	—	West Coast of America, Ltd. ..	2½	1/16 — 1/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100—102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	11/16 - 13/16
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8½— 9
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6¾— 7¼
£80,000	100	5%	Do. 5% Deb.	100	101 —104
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13⅜—14⅛
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	102½—104½

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5% Cum. Pref.	10	9 — 9½
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	101—103
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	96 — 98
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5⅜— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	11⅜— 12¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4⅞— 5¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	103—105
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1½ — 1⅝
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5¼
36,758	8	4/9⅜	Do. Non-Cum. 6% Pref.	8	8 — 8½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2⅝
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2⅝— 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	86 — 88
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum. Pref. ..	10	4 — 4½
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	130 —133
£1,160,000	Stk	19%	Do. do. Deferred ..	100	228 —231
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	35 — 36
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4⅜— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4⅜
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8⅞— 9½
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10⅜— 11
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9⅜d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 3/16—1 5/16
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	128 —128*
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 24½*
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	⅛ — ⅜
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅜— ½
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ —1⅜
135,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1 1/16 —1 3/16

RAILWAY CARRIAGE & WAGON COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	22 — 23
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8⅞— 9¼
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13⅜—14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9½— 10
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4¼
14,567	10	1/3	Lancashire Wagon, Ord.	2	2¼— 2⅜
4,150	10	5%	Do. do.	10	10⅜ - 10½
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	42/6—43/6
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/9—24/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	28/6—29/-
20,000	20	20/-	Midland Rail.-Car & Wagon, Ld., 1-20,000	10	18 —19*

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅜ — ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	⅞ — ⅞
120,000	1	1/2½	Bell's Asbestos Co., Ltd.	1	1 7/16 — 1 7/16
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5⅜ — 6¼
100,000	5	3/-	Do. 6% Cum. Pref.	5	5⅜ — 6¼
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	103 —106
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	99—101*
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 5% Pref. ..	5	2⅜ — 2⅝
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	85 — 89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½ — ⅝
150,000	2	2/4½	Do. 6% Pref.	2	1¼ — 1⅜
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	90 — 93*
£125,000	Stk	4a%	Do. 4½% Perp. 2nd Deb. Stk.	100	78 — 81
35,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10 — 11
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5¼ — 5⅝
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	103½ —110½
85,000	3	1/6	Crompton & Co., Ltd...	3	1¼ — 1⅜
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	95—100⅝
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7⅜ — 8½
61,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6½
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
283,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 —109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1⅛ — 1⅜
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2 — 2½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	83 — 88
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	89 — 94
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	11/16 — 15/16
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	1⅜ — 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92 — 95
10,248	10	7/6	Evered and Co., Ltd...	10	10 — 12
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12 —13*
35,000	5	2/3	Do. 4½% Cum. Pref... ..	5	5¼ — 5½*
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111*
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15½ — 16½
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/8—16/9
97,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	34½ — 36½
£150,000	100	4%	Do. 4% Deb. Bonds	100	102—104

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅝ — 9⅛
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅝ — 6⅜
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141 —144
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13⅜ — 14½
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9½ — 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98 —101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97 —102
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	⅞ — 1
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	1/16 — 1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1 — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	4 — 4½
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	95 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	111—114
		5%	Pref. Ord. Stock	100	102—105
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	8 — 8½
156,487	10	6/-	Do. 6% Cum. Pref.	10	10½ — 11
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	122 —124
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	98 —100
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3 — 3½
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5⅛ — 5⅜
27,000	5	3/-	Do. "B" do.	5	4¼ — 5¼

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	97 — 99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101 —105
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9⅜ — 10½
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	107 - 109
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1½ — 1½
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4⅞ — 5¼
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 —102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	103 —105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½ — 14½
59,987	10	6/-	Do. 6% Pref...	10	15 — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2½ — 3
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	88 — 88
125.000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9⅜ — 10½
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99 —102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	103 —105
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	⅛ — 3/16
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 —1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105 —107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ — 1½
110,928	8	2/9⅜	North Metropolitan Tramways Co..	8	4½ — 4¾*
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	93 — 98
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	103 —106
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8⅝ — 9½
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9 — 9⅝
£220 000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101 —104

IV.—ELECTRIC LIGHTING AND POWER.

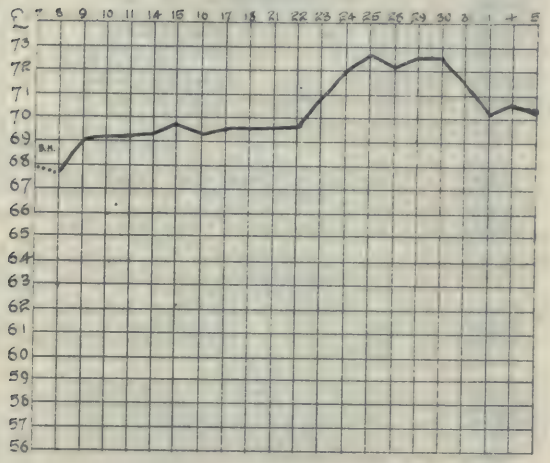
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11⅜ — 12¾
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9⅞ — 10¾
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	105 —107
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5⅜
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	104 —107
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9⅜ — 10¼
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9⅝ — 10⅜
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9¼ — 9⅝
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	103 —106
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	6⅜ — 7½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5¼ — 5⅜
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103 —105
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6 —6½
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk. Red	100	108 —110
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	10⅜ — 11½
40,000	10	6/-	Do. 6% Cum. Pref.	10	13 — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 —127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	8½ — 9
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 —12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red, ..	100	111 —114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5⅜ — 6¼
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 1/16 — 6 3/16
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	105 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85 — 90
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5½ — 5⅝
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	99 —102
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9⅛ — 10⅜
13,000	5	5/-	Hove Elec. Lighting Co., Ld., Ord.	5	7⅞ — 8½
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	¾ — ⅞
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12 —12⅜

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM AUGUST 7TH TO SEPTEMBER 5TH, 1905.

COPPER.



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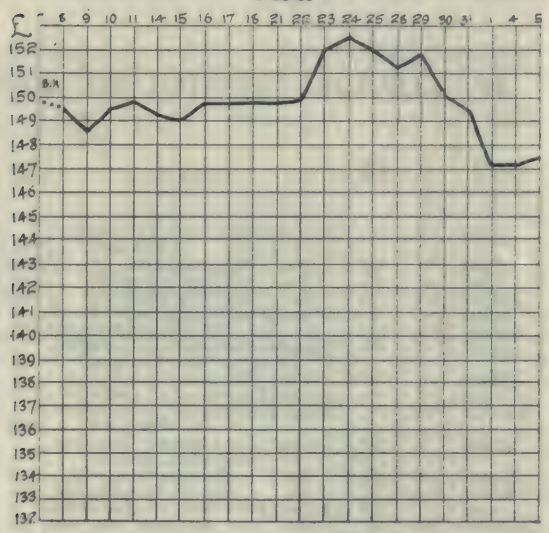
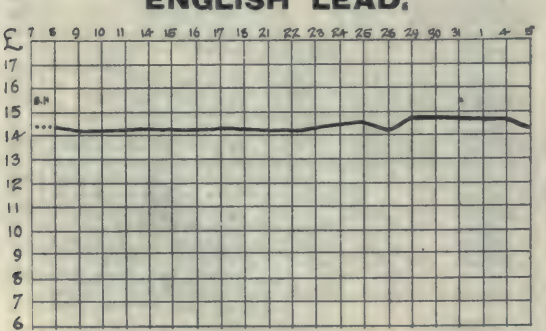


ENGLISH LEAD.



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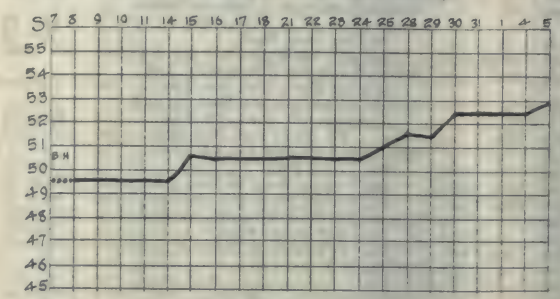

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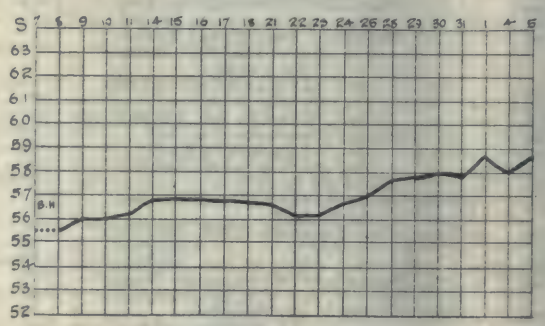

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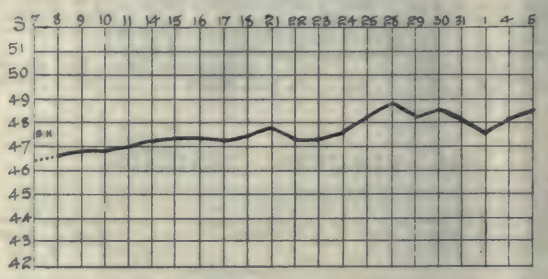

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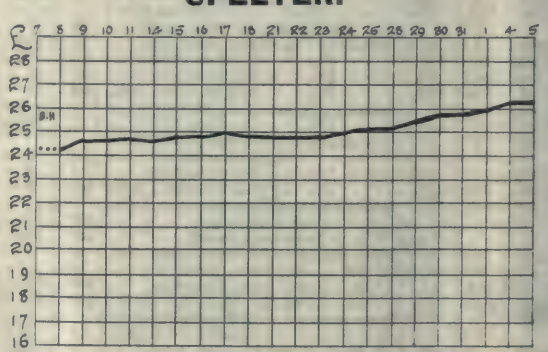


PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, September 6th, 1905.

SOME determined selling on the part of bears, has brought about a sharp decline in the price of standard copper, and after dealings had taken place as high as £72 10s. for September metal, there was a sharp relapse to £69 15s. There has however been some recovery from the lowest, and the market exhibits a rallying tendency, the latest prices being £70 12s. 6d. cash and £70 7s. 6d. three months. The position of refined copper has been unaffected by the slump in the speculative medium and values are about the same as they were a week ago.

The fall in the price of Tin has been more pronounced than in the case of the sister metal, the result of large sales for forward delivery by leading operators. These latter have taken advantage of the collapse in the price of silver, which Merton and Co's circular states was not unnaturally expected to bring about a depreciation of values in the Straits. The highest price touched during the week was £152 cash and the lowest £147 2s. 6d. which was the closing price yesterday.

Lead remains firm, large transactions at rising prices being reported from the Continent. The rise is due to the strong consumptive demand, which is bringing into sharp relief the paucity of supplies. Soft foreign prompt is quoted at £14 10s., with English at 5s. higher.

Spelter has been a strong market both here and on the Continent. There is a very large demand from consumers, and a shortage of the metal is probable. Quotations have risen to £26 5s. G.O.B. prompt, Specials at £26 15s.

Irregularity has marked the course of the pig iron market, and the announcement of peace as in other sections of the speculative metal markets was followed by a crop of realisations, with the result that the price declined to 47s. 10½d., although some slight recovery from the lowest values is to be noted. The outlook, however, is not unsatisfactory; large shipbuilding orders have again been given out and there is a general demand for steel products. In addition to the cargo of Cleveland Foundry iron reported sold to the States a short time ago, it is now stated that a quantity of hematite iron has also been disposed of.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:		£	s.	d.
DALZELL STEEL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
	,, ,, ,, Land ,, ,, ...	6	17	6
	,, Steel Bars, Boiler Quality	7	0	0
DALZELL STEEL	Siemens' Steel Plates, Ship Quality Plates.....	5	17	6
	,, ,, Bars ,, ,, ...	6	10	0
	,, ,, Angles.....	5	10	0

Manufactured Iron:

Bars—Dalzell.....		6	5	0
,,	Best	6	15	0
,,	,, Horseshoe	6	15	0
,,	Angle.....	6	5	0
,,	Best Angle	6	15	0
,,	Best Best	7	5	0
,,	Extra Best	7	15	0

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

(Glasgow ♔ Steel)	£	s.	d.	
Steel Angles	5	10	0	per ton.
Steel Ship Plates	5	17	6	,,
Steel Bars, Ship Quality	6	10	0	,,
Glasgow ♔ ♔ Steel.				
Steel Bars, Boiler Quality	7	0	0	,,
Steel Land Boiler Plates	6	7	6	,,
Steel Marine Boiler Plates	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., quote:—

		£	s.	d.
Bars—Phœnix		6	7	6
,,	Best	6	17	6
,,	Best Best	7	7	6
,,	Extra Best.....	7	17	6
,,	Best Horse Shoe	6	17	6
,,	Extra B.H.S.	7	17	6
,,	Extra Best Cable	8	7	6
,,	Rivet	6	7	6
,,	Best Scrap Rivet	7	7	6

	£ s. d.
Angles—Phœnix	6 5 0
,, Best	6 15 0
,, Extra Best	7 5 0
Gas Tube Hoops—Phœnix Best	6 15 0
Plates—Phœnix	—
,, Best Boiler	7 10 0
,, Best Best Boiler	8 0 0
,, Extra Best Boiler	9 0 0
Boiler Tube Strips—Phœnix Best Best	8 0 0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:

	No. 1. £ s. d.	No. 3. £ s. d.
Coltness, f.a.s. Glasgow	—	2 14 0
Gartsherrie ,,	2 18 6	2 13 6
Summerlee ,,	2 18 0	2 13 6
Carnbroe ,,	2 15 6	2 13 0
Langloan ,,	3 0 0	2 15 0
Calder ,,	2 18 6	2 13 6
Clyde ,,	2 18 6	2 12 0
Glengarnock, f.o.b. Ardrossan	2 18 0	2 13 0
Eglinton ,, ,,	2 14 6	2 12 0
Dalmellington, ,, Ayr	—	2 12 6
Shotts ,, Leith	2 18 6	2 14 0

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£ s. d.
W.W. ♔ Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby ♔	8 2 6
Thornaby Best	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W. ♔ Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
Tee Iron, to 8-inches United	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron. £ s. d.	Steel. £ s. d.
♔ (ENF)	Bars	6 10 0	6 15 0
	Angles	7 0 0	7 5 0
	Tees	7 10 0	7 15 0
♔ W.I.W	Hoops	7 0 0	7 10 0
	Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton. £ s. d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £ s. d.
Black Sheets		
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Severn"	11 10 0	12 10 0
"Baldwin Wilden B."	12 10 0	13 10 0
Charcoal	16 10 0	17 10 0
Best Charcoal	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£ s. d.	£ s.
No. 3 Lead	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne	16 10 0	17 10 0

	Singles 20 G to 108 by 36in. per ton. £ s. d.	Doubles 21 to 24 G to 96 by 36in. per ton. £ s. d.
Tinned Sheets:		
Best Coke (Finish)	29 0 0	30 10 0
,, Charcoal (Finish)	31 0 0	32 10 0
Extra ,,	33 0 0	34 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£ s. d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	12 10 0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14 15 0	,,

Galvanized Working Up-Sheets:

	£ s. d.	
24 G., f.o.b. London, in Bundles	13 10 0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.	
Crown Bars	6 10 0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7 0 0	,,
Angles	6 15 0	,,
,, Best	7 5 0	,,
T's	7 0 0	,,
,, Best	7 10 0	,,
Best Shoe Iron	8 0 0	,,
,, Rivet Iron	8 0 0	,,
,, Best Rivet (Special)	9 5 0	,,
,, Cable	9 5 0	,,
,, Screwing	8 5 0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 8dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18⅜ by 14 124s. 110 lb. "BV"	0	12	4½
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	4½
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	0
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	9

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d	
Blooms	at 3	16	0	per ton.
Billets	at 3	18	0	,,
Sheet Bars	at 4	0	0	,,
Finished Steel:				
Bars	at 5	0	0	per ton.
Angles	at 5	1	0	,,
Tees	at 5	5	0	,,
Joists	at 4	12	6	,,
Fencing Standards	at 5	3	0	,,
Shoeing Bars	at 5	5	0	,,
Tyre Bars	at 5	5	0	,,
Half-Round Bars	at 5	10	0	,,
Heavy Rails	at 5	5	0	,,
Light Rails	at 4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	148	0	0	to	148	10	0	per ton
English Bars, f.o.b. Dis. 1¼% & 1%	149	0	0	to	149	10	0	,,
Straits G.M.B., cash Warehouse, Net	147	5	0	to	147	7	6	,,
Straits G.M.B., 3 months, Warehouse, Net	146	12	6	to	146	15	0	,,
Australian, Mt. Bischoff, Warehouse, Net	148	0	0	to	148	5	0	,,

COPPER

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	70	10	0	to	70	11	3	per ton.
Standard G.M.B., 3 months, Warehouse, Net	70	0	0	to	70	2	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	76	0	0	to	76	10	0	,,
English, Best Select, Warehouse Net	77	0	0	to	77	10	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	86	0	0	to	87	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	80	0	0	to	—			,,
Electro, Warehouse, Net	78	0	0	to	78	5	0	,,
Ore, ex. ship	0	12	9	to	0	13	9	per unit.
Regulus, Matte and Precipitate, ex ship,	0	13	9	to	0	14	6	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6⅜	per lb.
Sheathing ,, ,,	0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	26	5	0	to	26	7	6	per ton.
Blende of 50 % Net	6	10	0	to	6	15	0	,,
Calamine, Net	6	15	0	to	7	0	0	,,

LEAD

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	14	12	6	to	14	15	0	per ton.
Spanish, 2½%	14	7	6	to	14	10	0	,,
Lead Ore of 70 %, Net	7	5	0	to	7	7	6	

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	£0	0	0	to	61	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	16	10	0	to	18	0	0	,,
Crude, ex ship, Dis. 2½ %	37	0	0	to	40	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	2	6	per flask
Italian ,, ,, ,,	7	0	0	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	6	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	1	0

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit :—

Digby Coal:

Steam.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

High Hazel.

London Brights, 4 to 8 in. cube	9	6
Bright Cobbles (Hand Picked)	9	0
Large Nuts, 2 to 4 in. cube	8	0
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0

Steam.—Top Hard.

Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb.
	Picric, Crystals	0	0	10	,,
	Tartaric at Manchester	0	0	10¾	,,
Acetate of Lime:	Brown at Manchester net	8	10	0	per ton.
	Grey ,,	11	15	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, deld. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	11	3	,,
Arsenic:	Best White Powdered net	13	0	0	,,
Bleaching Powder, 35%	,,	4	7	6	,,
Borax:	British Refined Crystal ,,	13	0	0	,,

Coal Tar Products:

Benzole, 50/90 %	,,	0	0	7	per gal.
,, 90%	,,	0	0	6½	,,
Carbolic Acid Crystals, 34/35° C.	,,	0	0	5⅝	per lb.
,, ,, ,, 39/40° C.	,,	0	0	6½	,,
,, ,, Liquid, 97/99 %	,,	0	0	9	per gal.
,, ,, Crude, 62½ % at 60° F. f.o.b.	,,	0	1	7⅛	,,
Creosote, ordinary good liquid	,,	0	0	1⅜	,,
Naphtha, Crude, 20 % at 120° C.	,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b	,,	0	0	8½	,,
,, ,, 95 % at 160° C. ,, ,,		0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,		0	0	10½	,,
,, Rectified, flash point over 73° F. f.o.b.	,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b.	,,	0	1	0	,,
Naphthalene, all qualities.					
Pitch f.a.s. Manchester.	,,	1	7	6	per ton.
Copperas: Green, in bulk	,,	0	12	6	,,
,, barrels f.o.b. L'pool	,,	1	17	6	,,
Cake	,,	1	2	6	,,
Copper: Sulphate		22	0	0	,,
Cyanides: 98% minimum f.o.b. net		0	0	7½	per lb.
Lead: Acetate (Sugar) White, English		27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K		25	10	0	,,
,, ,, Grey		21	15	0	,,
,, ,, Brown at Manchester		16	15	0	,,
Nitrate		25	0	0	,,
Litharge, Flake		16	10	0	,,
,, Powder		17	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%		16	0	0	,,
White ,, ,, Dry ,, ,, ,,		17	0	0	,,
Naphtha (Wood): Miscible, 60 o.p.		0	2	6	per gal.
Solvent		0	2	7	,,
Potash: Bichromate... delivered England		0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull		18	0	0	per ton.
Caustic, 75/80 % ,, ,,		20	5	0	,,
Chlorate net		0	0	3 1/16	per lb.
Montreal in Store, Liverpool		31	10	0	per ton.
Prussiate Yellow net		0	0	4⅞	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
	,, ,, ,, Refined..... ,,	6	5	0	,,
	,, Carbonated, 48 %..... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) .....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % .....net	6	10	0	,,
	Caustic, White, 77 %..... ,,	10	12	6	,,
	,, ,, 70 %..... ,,	9	12	6	,,
	,, ,, 60 %..... ,,	8	12	6	,,
	,, Cream, 60 %..... ..... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate ..... c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs.....	6	15	0	,,
	Bichromate.....delivered England...	0	0	2¼	per lb.
	Chlorate ..... net	0	0	3 1/16	per lb.
	Nitrate . ex quay Liverpool, ... ,,	10	10	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate .....net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts).....	1	10	0	,,
	,, (Saltcake, 95%).....	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers.....	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	9	0	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports.....	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool 10½d.	per metallic unit.			
Ochre:	French JC ..... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk)..... c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	0	to	0	13	0	per unit.
Regulus, 45 to 55%	0	13	3	to	0	13	9	,,
Precipitate, 65 to 80% ...	0	13	4½	to	0	13	10½	,,
Tin Ores, 70 %.....	91	0	0	to	93	0	0	per ton.
Lead Ore, 70%					6	19	0	,,
Blende, 50%					6	9	6	,,
Calamine.....					6	12	0	,,
Antimony Ore, 50%.....	20	0	0	to	22	0	0	,, nom.

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%, ...f.o.b.	Porman		6	4	per ton.
Do. ..... ,,	Cartagena		6	7	,,
Special low phos. ,,	Porman		6	10	,,
Do. do. ,,	Cartagena.....		7	3	,,
Extra quality do. ,,	,, ...		7	6	,,
Special Iron Ore ..	,, ...nominal				,,
Specular 58% do. ,,	,, ...		10	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine.....	,,	0	1	8		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	5		0	2	0
Birch Planks.....	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	5	0		7	10	0
Nova Scotia Spruce..	,,	7	2	6		7	7	6
Spruce Boards.....	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak.....	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish..... ...	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.....	,,	0	1	2		0	1	9

Deals.

Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When patents have been communicated the names of the communicators are printed in *italics.*

16861. T. Burgess and W. E. Scragg, Manchester. August 21st.—Improvements in air-compressors and valves therefor.

16906. R. Westall, Surrey. August 21st.—An improved rotary engine.

16912. O. M. Hudson, London. August 21st.—Improvements in carburettors.

16921. J. Raven, London. August 21st.—Improvements in ratchet drills.

16932. A. Winton, London. August 21st.—Improvements in starting and igniting mechanisms.

16989. A. W. Hordern, Birmingham. August 22nd.—Improvements in bolt heading machines.

16995. J. Stone and Co., Ltd., and W. R. Preston, London. August 22nd.—Improvements in or connecting with displacement lubricators.

17004. F. Pelissier, London. August 22nd.—Improvements in or relating to mechanism for propelling ships.

17012. G. C. Marks, London. August 22nd.—Improvements in and relating to engines. (*The Stratton Rotating Engine Company, United States.*)

17021. J. H. Holman, and J. M. Holman, London. August 22nd.—Improvements in or connected with winches.

17022. W. Blakeway, London. August 22nd.—Improvements in brakes and clutches.

17087. J. E. Thornycroft, R. Donkin, and V. G. Barford, London. August 23rd.—Improvements in valve operating mechanism suitable for reversible internal combustion engines.

17088. W. Panter, London. August 23rd.—Improved construction of machine for printing and ruling on paper.

17090. The Vauxhall and West Hydraulic Engineering Company, Ltd., and A. E. Ash, London. August 23rd.—Improvements in change speed gear.

17130. M. Riddell, Glasgow. August 24th.—Improvements in ignition devices for starting gas engines.

17140. R. S. S. Bellamy, Manchester. August 24th.—Improvements in lubricators. (*Stephen Masters, Transvaal.*)

17157. A. Kohl, and K. Hebermann, Z. Langnau, Switzerland. August 24th.—Boring machine.

17159. A. L. Cliburn, London. August 24th—An improvement in carburettors for internal combustion engines.

17194. C. Taylor and G. B. Taylor, Birmingham. August 25th.—Improvements in screw-thread milling apparatus.

17200. J. J. Fraser, Edinburgh. August 25th.—Improvements in or relating to grinding mills.

17212. W. C. Hughes, London. August 25th—Exhaust valves for internal combustion motors.

17215. T. Greves, Warwick. August 25th.—Improvements in igniters for oil engines.

17233. G. Frost, London. August 25th.—Improvements in rotary motors.

17329. C. Bernhardt, London. August 25th—Improvements relating to excavators. (Date applied for October 27th, 1904.)

17294. L. P. Strickland, London. August 25th.—Improvements in paper-making machines.

17275. W. E. Nicholson, Newcastle. August 26th.—Improvements in water-tube boilers.

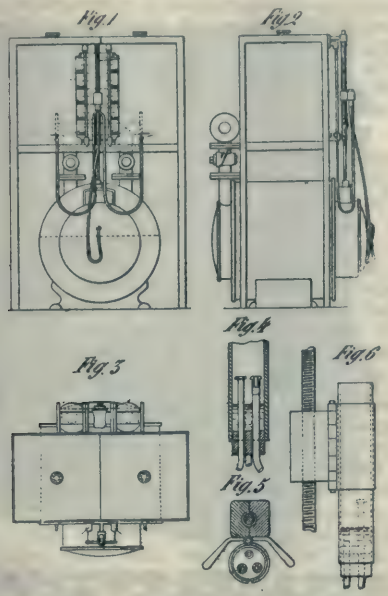
17309. H. J. Hadden, London. August 26th.—Improvements in carburrettors for internal combustion engines. (*A. C. Stewart, United States.*)

RECENT SPECIFICATIONS.

AUTOMATIC APPARATUS FOR CARBURETTING AIR AND OTHER GASES.

F. Bouchand-Praceiq, France. June 22nd, 1905.—This invention relates to an apparatus serving to effect in an automatic manner either the carburation of air or of any gas, with a view to render it combustible and consequently suitable for furnishing light, heat or motive power, or for the enrichment of gases already combustible but of an insufficient calorific or luminant power, such as water gas, gas from wood and generally all poor gases, or for effecting the dilution of the gas having excess of the carburation, such as acetylene. Fig. 1 is a front view, fig. 2 a side view, fig 3 a plan, figs. 4, 5 and 6 are respectively a vertical section, a horizontal section and a side view of the actual dosing apparatus. The apparatus consists of two reservoirs, containing the carburetting liquid and which can be put alternately into action, so as not to interrupt the supply during the filling of one thereof. Each of these reservoirs is provided with a level indicator tube, showing by a suitable scale the contents of this reservoir; a cock at the bottom of each reservoir is connected by means of a

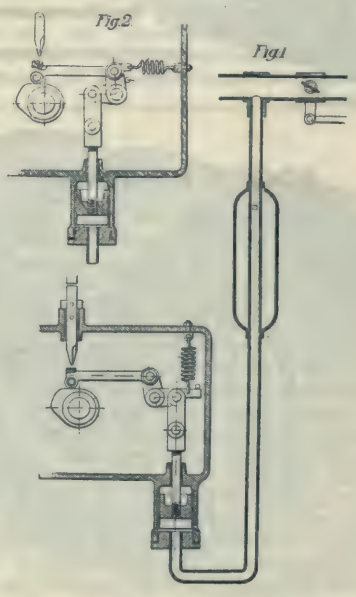
flexible pipe with the dosing apparatus, which is composed of a transparent gauge tube closed at the lower end by means of a plug through which pass three tubes. Two of these tubes are arranged with an upper mouth constituting a discharge for the carburetting



liquid and they communicate respectively with the flexible tubes; the third tube seen on the left at the bottom in fig. 6 serves for collecting the liquid which passes into the gauge tube and to conduct the same through a flexible tube into a gas-meter of suitable size shown on the drawing. The liquid spreads in a thin layer upon the water contained in the meter and evaporates instantaneously in contact with the gaseous current passing through the apparatus. A vessel is mounted in a sleeve carried by a screw nut formed in two parts articulated by means of a spring hinge and embracing a screw spindle arranged vertically in front of the apparatus; this screw is situated on an axis connected with the drum or the clockwork of the meter such as, for example, one revolution per cubic meter of air passing through the apparatus. The pitch of the screw is determined by the other conditions of the construction of the apparatus in such manner as to realise a constant degree of carburation whatever may be the quantity of gas that the apparatus has to supply.

IMPROVEMENTS IN THE GOVERNING ARRANGEMENTS OF INTERNAL COMBUSTION ENGINES.

M. Albert de Dion and G. Bouton, France. July 27th 1905. This invention has for its object to provide improved governing of explosion engines by a mode of regulation consisting in so acting on the exhaust valve that when the speed of rotation exceeds a predetermined number of revolutions in a given time the escape of the burnt gases and the admission of explosive mixture are prevented from taking place. This result is secured by causing the depression produced in the suction pipe by the increased speed of rotation to act, through suitable gearing, on the mechanism controlling the exhaust valve. In the accompanying drawings fig. 1 shows a device in accordance with this invention, and fig. 2 shows a slight modification in the arrangement. The devices illustrated comprise a cylinder or chamber in constant communication with a suction pipe supplying gases to the motor. Inside this cylinder or chamber is a piston connected as shown to a lever fixed on a shaft. The piston can, of course, be replaced by an equivalent such as a diaphragm or membrane provided the cylinder or chamber be thereby divided into two parts, one of which communicates with the atmosphere, whilst the other is in communication with the suction pipe of the motor. To the shaft is fixed an arm to the end of which is pivoted a bar, or finger, the head of which, under normal conditions, is situated between the cam controlling the exhaust valve and the bevelled lower end of the rod of the exhaust valve. Under normal working conditions, when the projection of the cam passes under the head of the bar, or finger, a part of the said head acts on the bevel of the rod and thus causes the exhaust valve to open. When the speed of the motor increases, the depression in the suction pipe becomes sufficient to cause the piston to move downwards. The lever is thus moved to a predetermined extent which is such that the part at the head of the bar, or finger, is no longer under the rod and then, when the projection of the cam passes under the said part, the rising motion of the bar, or finger, is not imparted to the exhaust valve which remains closed and during the subsequent phase of the cycle the admission of explosive gases to the engine, does not take place. Thereafter, depression in the admission pipe having decreased, the piston is no longer drawn downwards and a spring brings the bar under the rod, so that the said bar, or finger, is then raised at the proper time. A stop limits the movement of the parts. The aforesaid description



applies to both figs. 1 and 2, the levers being merely arranged in the one case so that the bar, or finger is moved in one direction, and in the other case, in the other direction, to discontinue the operation of the exhaust valve

NEW PUBLICATIONS.

"CIVIL ENGINEERING."

By T. Claxton Fidler, M.Inst.C.E., Methuen and Co. 2s. 6d.

In this latest addition to the well-known "Books on Business" series, Professor Fidler, of the Dundee University College, undertakes to eschew the technical language of a scientific treatise, and tell the story of rise and progress of Civil Engineering in this country in a manner that will interest the casual reader and prove useful to the busy man who happens to be interested in this important subject. At the outset its origins are dealt with, the writer then discussing its true character as a civil profession. In the subsequent chapters which deal with its progress, except for the few instances where the writer has drawn on his own experience, the student of general history will probably find but little with which he is not already familiar. The author's object in the three following chapters has been to describe the ordinary occupations of the civil engineer and the duties that devolve upon him in the various positions he may occupy. The intimate relationship between science and engineering is then considered, followed by an interesting chapter on that much discussed question, the education of an engineer. Concerning the present outlook Professor Claxton Fidler maintains a healthy optimism. He believes that the future of engineering is still full of promise for the world and also for the profession. We have still to provide for the plain uses and conveniences of man over a great part of the semi-civilised earth, he writes, and at home there are still a great many human needs which have not yet engaged the attention of engineers and which might be fulfilled by the great sources in nature. The book is illustrated with a series of excellent whole page views among which are the Nile dam at Assouan, the Barton swing bridge, the *Lucania* and the *Caronia*, etc. In conclusion the writer details the qualifications necessary for the several classes of membership of the Institution of Civil Engineers.

BOOKS RECEIVED.

We have also received the following:—From the British Fire Prevention Committee, Red Books No. 96 and 98. The first deals with the fire test made upon a solid 2 in. composite door with a flat surface both sides, oak faced, and a five-panelled 2 in. composite door, moulded both sides, oak faced. The second test, on a floor by the National Fireproofing Company, is one of unusual interest, this being the first test made by the Committee with a fire-resisting floor constructed of semi-porous terra-cotta blocks with steel wire reinforcement. "Transactions of the North-East Coast Institution of Engineers and Shipbuilders" volume xxi., parts 8 and 9 (Andrew Reid and Co.), Session 1904–5, contains the following admirably illustrated papers, "Boiler Furnaces and the effect of oil on their ultimate strength," by D. B. Morrison. Reply to discussion on "Petrol Motor Cars," by Frank Little, and J. F. C. Snell's reply to the discussion on his paper on "The application of Electricity to Industrial Purposes." The "Transactions of the Mining Institute of Scotland" includes an important paper by Archibald Russell on "The Coal-fields of Cape Colony," accompanied with maps and sectional drawings.

NEW CATALOGUES.

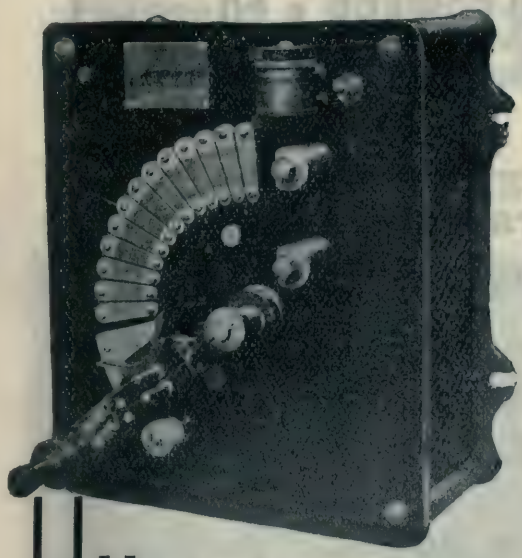
Messrs. James Watt and Co., Soho Foundry, Birmingham, have issued a circular on the "Watt" Suction Gas Producer, which is described as a simple and neat mechanical development from a comparatively clumsy and complicated origin. It is applicable to both new and old gas engines, and it is claimed that its adoption results in a saving of four-fifths to five-sixths the cost of town gas. The producer is made for engines as small as 7½ b.h.p., and above that to any reasonable power.

The Globe-Wernicke Company, Ltd., list No. 7 deals with desks, chairs, library tables, elastic book cases, letter filing cabinets, card index systems, etc., and is fully illustrated. A useful adjunct to the desk appears to be the Globe Telephone Holder which is shown and described at the end of the catalogue. The holder allows the telephone to be extended from 18 to 26 in. It is attached to the side of the desk and judging from the half-tone illustrations it should be an excellent time-saver.

Messrs. W. N. Brunton and Son, of Musselburgh, Scotland, have just issued some well arranged catalogues of wire ropes. The dimensions and prices are set out so clearly that they will be found useful to file for quick reference. Special attention is given to shipping ropes and appliances, the firm being manufacturers of flexible steel wire ropes for ships' hawsers, cables, fishing lines, running gear, trawl warps, cargo falls, etc., etc., special plated wire ropes for yachts, and, in fact, all appliances for working with wire ropes. They have also issued a very useful card, giving dimensions, weight and breaking strains of round wire ropes for mining purposes. We note that Messrs. Brunton and Son claim to be the only firm in Scotland who are making wire ropes from the commencement, *i.e.*, drawing their own wire and spinning their own ropes.

H. W. Ward and Co., Birmingham.—The latest information about the firm's wire feed capstan lathes will be found in section 1 of a new illustrated catalogue. It is sometimes alleged that makers of machine tools in this country are not so willing as they might be to take every possible trouble to secure orders in competition. A preliminary announcement in the catalogue under notice shows that in the case of Messrs. Ward and Co. at any rate, this charge is impossible. They say: We will, on receipt of samples, advise as to which is the best lathe for producing particular work, and also quote for the full set of tools necessary, and give guaranteed times of production. When this arrangement is made the machines are fixed and run in our own works, and the articles are produced to our customers' satisfaction and in our guaranteed times, before delivery. Arrangements may be made for skilled operators to be sent out to customers' own works, to start up the machinery, and to give instructions in its manipulation. We have always some of the tools running in our works, and are pleased to show them to intending buyers. Special attention is called to the two different countershafts quoted with all the firm's wire-feed capstans, the one for brasswork and the other for general work. Particular care has been given to the speeding of these; the brass speeds are suitable for high-speed rod work only, and not for castings. It is, of course, impracticable to give speeds in a catalogue suitable for all kinds of metal and work. Special advice can be had on application.

PAGE'S WEEKLY — Miscellaneous



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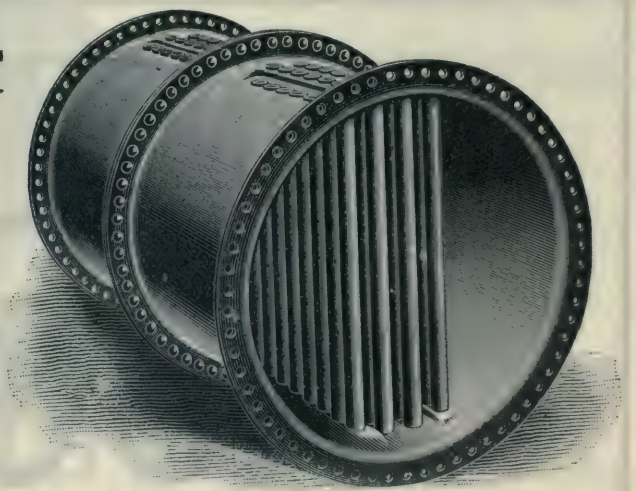
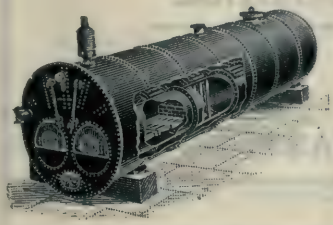


Part view of Flue fitted with PREMIER TUBES.



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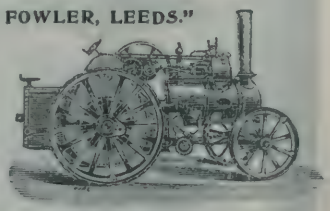

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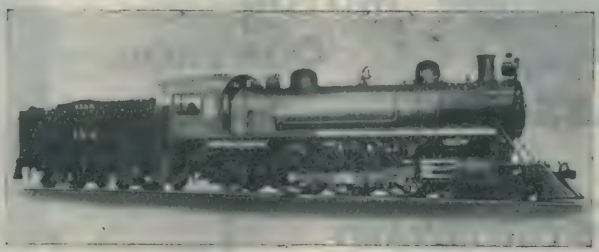

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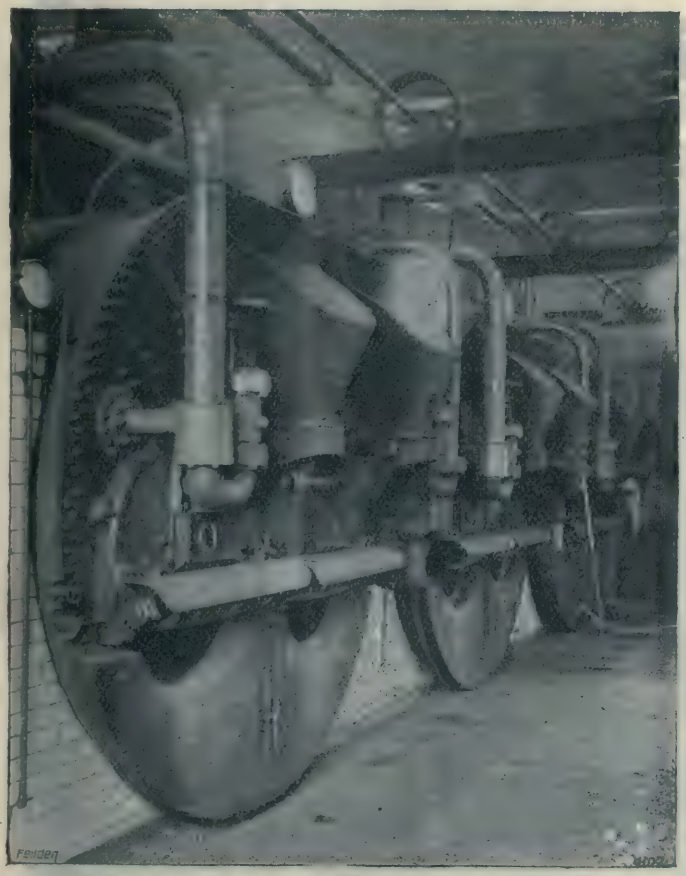

Photograph of Boiler House in a Cotton Mill, showing Bennis Stokers and Compressed Air Furnaces.

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ED. BENNIS & CO., LTD.,

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BY

PAUL J. MALLMANN, M.A.,

Civil and Consulting Engineer, and Coke Oven Expert,

110—118, VICTORIA STREET, WESTMINSTER, LONDON, S.W.

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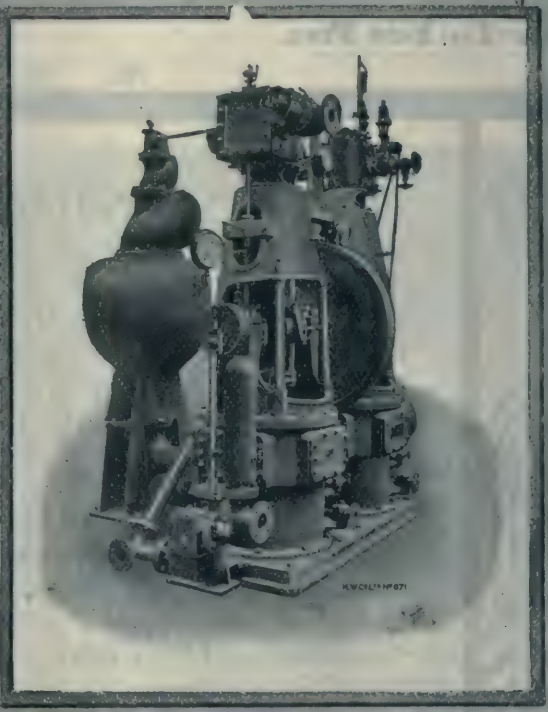

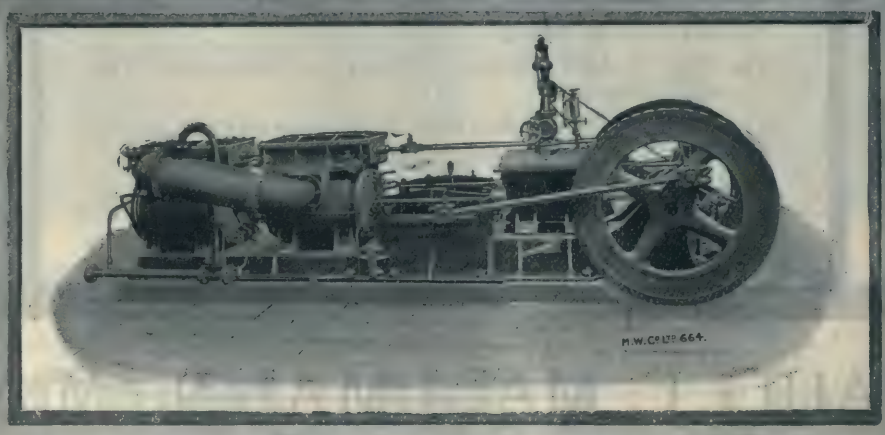

PAGE'S WEEKLY — Boilers

PAGE'S WEEKLY

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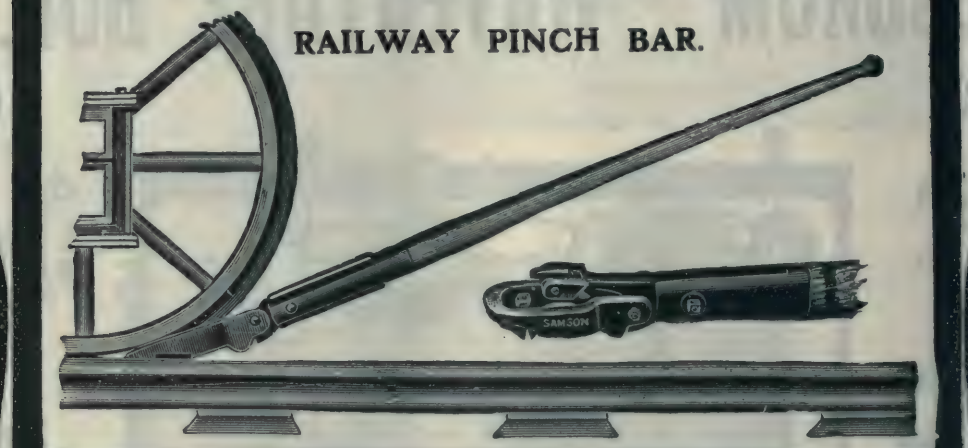

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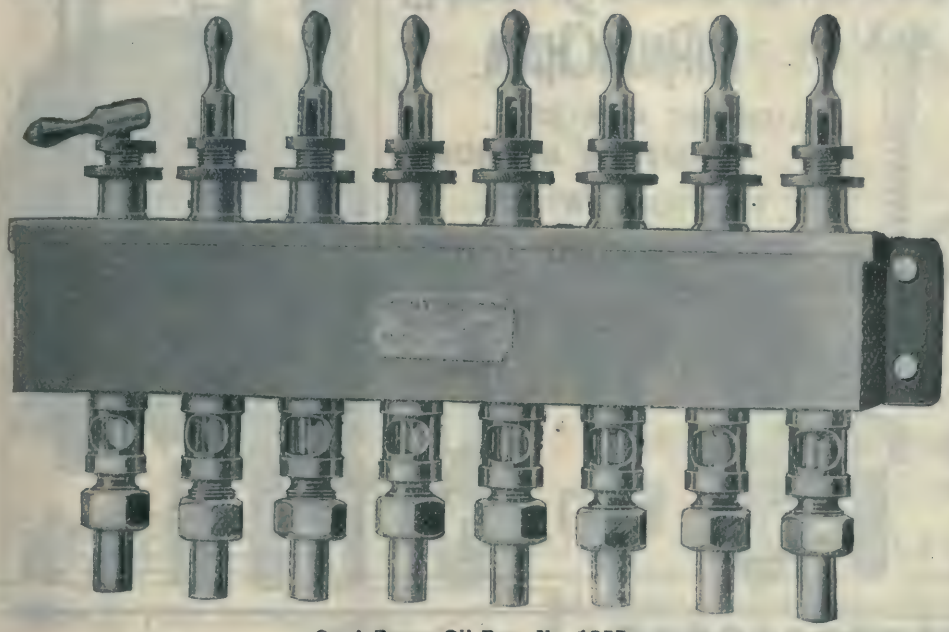

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PAGE'S WEEKLY — Electrical Apparatus, &c.

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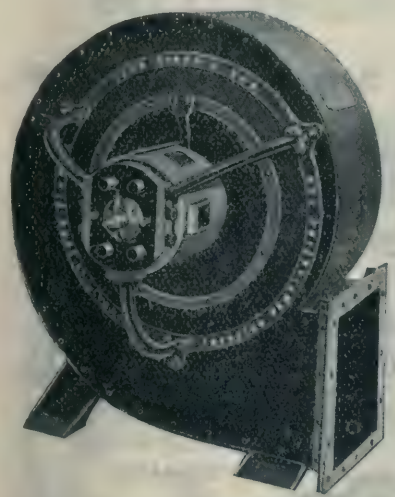

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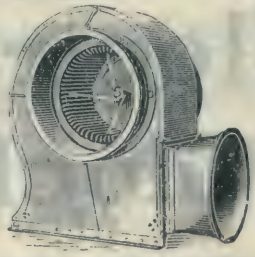
Highest Award, Grand Prize, St. Louis Exhibition, 1904.



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PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY — Railways

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AND

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(Charing Cross Station)	For Intermediate Stations ...	6.5 p.m.	†* 9.50 a.m.	For CALAIS only	
† 11.0 a.m.	from Victoria Station	6.45 p.m.	†* 12 noon		7.5 p.m. Victoria Station
‡ 9.0 p.m.	„ Charing Cross Station ...	5.50 a.m.	‡ 8.40 p.m. ...	Intermediate Stations	5.40 a.m. Charing Cross Station.

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Depart. from London.		Arrival in Paris.	Depart. from Paris.		Arrival in London.
‡ 10.0 a.m.	from Charing Cross Station	6.5 p.m.	‡ 8.25 a.m.	Intermediate Stations	... 3.45 p.m. Charing Cross Station.
†* 2.20 p.m.		9.15 p.m.	‡ 2.40 p.m.		10.45 p.m.
‡ 2.20 p.m.		11.25 p.m.	†* 4.0 p.m.	For Boulogne only ...	

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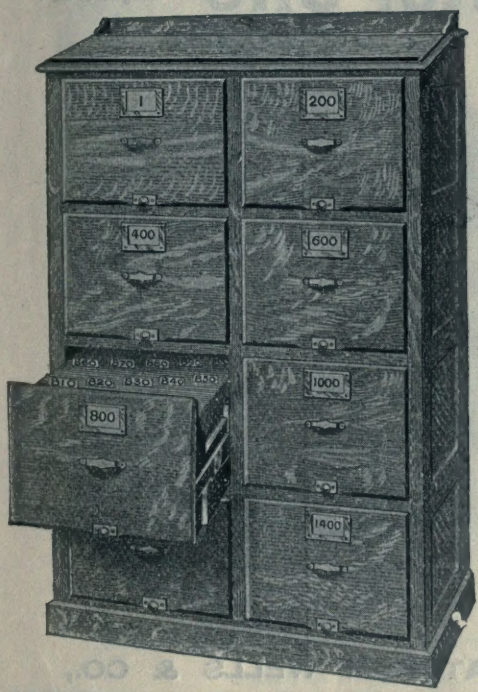

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